



Analysis of US Patent Referencing to IEEE Papers, Conferences, and Standards 2002-2021

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Executive Summary

Prior studies performed by 1790 Analytics have demonstrated a strong relationship between IEEE research and new patent development and have shown that citations to IEEE can often lead to higher impact patents. Specifically, the impact is measured by examining the extent to which patented inventions build upon papers from IEEE journals, IEEE-sponsored conferences, and IEEE standards. This is an update of previous reports and examines US patents issued from January 1, 2002, through December 31, 2021.

The main findings of this report are:

- New technology continues to build upon science, and the dependence is increasing. In this study, the top 50 firms (in 2021) were granted 95,072 patents, which made a total of 690,948 non-patent references (an average of 7.26 non-patent references per patent). Back in 2011, the top 25 firms were granted 51,826 patents. These patents made a total of 205,634 non-patent references, (an average of 3.97 non-patent references per patent) Thus, the number of patents is trending upward but the number of references from those patents is rising at a greater rate. Since many of these non-patent references are to scientific articles and conference papers, this suggests that today's technology developments are increasingly linked to developments in published science.
- A large portion of this science base comes from papers presented at IEEE sponsored conferences and published in IEEE journals. The top 50 patenting firms in 2021 have referenced over 2,613,407 articles in the last 20 years. About 25% (655,365) of those articles appeared in IEEE journals, IEEE sponsored conferences, or IEEE Standards Documents.
- In this study, we also went beyond the top 50 patenting companies and analyzed all patents from the last 20 years in several technology categories of interest to IEEE members and customers. For example, 31% of all scientific references from Computer Hardware patents go to IEEE publications. The second most referenced publisher is ACM (Association for Computer Machinery) with 17% of the referenced publications. In other Information Technology areas, such as Information Storage, Semiconductor Manufacturing, and Computer Software, the results are similar.
- In Telecommunications technology, IEEE is particularly important. The 668,085 references to IEEE articles, conferences, and standards represent 36% of all non-Patent references from Telecommunications patents since 2002. However, Telecommunications references contain a higher number of standards than other technologies which understate the extent to which IEEE provides the science base to this technology. If we remove the standards from the NPRs then, of course, IEEE loses 65,000 references to its 802 wireless standards, however, the 603,000+ references to IEEE journal articles and conferences represent over 51% of the total science references from Telecommunications patents. In other words, IEEE provides over half of the science base for new innovations in Telecommunications.

- Although we've generated reports like this for close to two decades, we try to add technology categories that are currently hot or emerging. In recent years we've added Blockchain and Distributed Ledgers, Cybersecurity, and Virtual and Augmented Reality. In these emerging areas, IEEE enjoys a two-fold lead over second place ACM.
- We also have three other areas containing older technologies that are having a renaissance (Artificial Intelligence (AI), Autonomous Vehicles, and Internet-of-Things related patents). In each of these areas, IEEE is the dominant publisher of the science base. In AI, IEEE enjoys a 3-fold lead over second place ACM. In Autonomous Vehicles, IEEE has a dominant lead (10-fold lead) over the second-place entry RELX/Elsevier. In the Internet-of-Things category IEEE has a 4-fold lead over second place 3GPP.
- In the Robotics and Intelligent Manufacturing category, 38% of the patent references are to articles published in IEEE journals or proceedings of IEEE sponsored conferences. Second place RELX receives about one-fourth as many references in the category.
- IEEE is referenced a surprising amount in areas that are not central to its mission.
 - In broadcasting technologies IEEE leads with 31.5% of the references, which is about 2.5 times as many as second-place International Telecommunication Union. The latter produces standards documents while the IEEE references are to standards documents as well as peer-reviewed scientific papers from journals and conferences.
 - For example, 7.61% of the science references from patents in medical devices go to IEEE publications. This ranks IEEE fourth behind RELX and Wiley, and Wolters Kluwer (with 20.17%, 9.79%, and 8.65% respectively). The latter publishers have hundreds of journals in the medical area, whereas IEEE has only a few, so the 7.61% figure is quite solid for a non-core area and not far from second place Wiley's 9.79%.
 - Optics is also somewhat surprising. The two optics societies: OSA – The Optical Society of America, and SPIE – The International Society of Optical Engineering sponsor many conferences and have several journal articles, but OSA has only a slight lead over IEEE which has a slight lead over SPIE. Specifically, OSA receives 16.24% of the references, IEEE receives 14.36% and SPIE receives 12.97% of the references from optics-related patents.
 - In Measuring, Testing, and Control, IEEE gets 18.80% of all references, which ranks ahead of the 14.55% of second place RELX while, again, RELX has many more journal titles in the space.

- Patents related to Power Systems and Transmission also reference IEEE publications most frequently. The 63,468 references to IEEE journal and proceedings papers are more than the next two top referenced publishers (RELX and Electrochemical Society) combined. We also examined a specialized subset of the Power Transmission category related to smart meters and smart grids. In this category, 55.97% of the scientific references from patents go to IEEE journals or conference papers. The second most referenced publisher is RELX with only 8.32% of all references.
- Several years back we started tracking some green energy categories: Solar and Photovoltaic energy and Wind energy. In the latter category, IEEE science has a big advantage over the other publishers with more than 42% of the references. In solar energy, IEEE has a smaller lead over RELX. RELX has more than 50 journal titles related to the area including several high-impact journals such as *Solar Energy Materials and Solar Cells*, *Thin Solid Films*, *Solar Energy*, *Synthetic Metals*, *Journal of Crystal Growth*, and *Solar Cells*, IEEE has only a few.
- It has been shown that high-quality, high-impact, and valuable patents tend to be cited more frequently by later patents. Citation impact is thus often used as a quantitative measure for evaluating patents (see [3]). In this study, we found that the patents that reference IEEE papers are cited more often than patents that do not. This was shown to be true for each of the twenty technology categories we examined. This suggests that, not only do IEEE publications frequently provide the science base for new inventions, but that inventions that build upon IEEE publications are more likely to be valuable in the future than inventions that do not build upon IEEE.
- Although this study concentrates on patents in specific technology areas, it should be noted that the importance of scientific and technical literature to patented technology is increasing in all areas. Our research shows that the average US patent had only 2.76 non-patent references (NPRs) back in 1997. That number jumped to 11.63 by 2021 – a 321% increase. These numbers are for all issued US patents and not just those in the twenty categories covered in this report.¹ This means that in the overall patent system, patented technologies are increasingly referencing scientific articles.
- Since we only look at specific categories of technology plus the top 50 firms, there is no way to know exactly how much referencing to IEEE has increased since 1997. However, we can estimate the whole patent system by identifying any Non-Patent References that mention “IEEE” or “I.E.E.E.” (This will of course miss things like the *Journal of Lightwave Technology* or *Spectrum* which may not have IEEE in the reference, but it will be a reasonable estimate.) If we do a comparison as above, we find that there were just 14,635 patent references with IEEE or I.E.E.E in 1997, but 141,081 in 2021 (an 864% increase). Thus, science referencing and IEEE referencing have both increased greatly since 1997.

¹ Including science intensive areas like Biotechnology, Pharmaceuticals, Chemicals, and other areas where IEEE typically has less influence.

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I. Introduction

In previous studies, it was found that patents reference papers from IEEE journals much more often than papers from other journal publishers. In this report, we update the previous results and study US patents issued from January 2002 through December 2021. Although this report is an update of previous results, we have made our best efforts to make this report self-contained. The aim of this report, as in previous reports, is to analyze references from patents to journal articles, conferences, and standards documents, to assess IEEE’s impact on technological developments.

This report covers twenty subcategories of Technology where IEEE members and readers are active. Many, but not all are related to Information Technology. The categories of patent counts are shown below in Table 1.

Table 1: Number of Patents for Each Category Covered in this Study

Category	# Patents 2002-2021
AI/Artificial Intelligence	31678
Autonomous Vehicles	7393
Blockchain/Distributed Ledger	3193
Broadcasting	207340
Computer Hardware	501299
Computer Software	301174
Cybersecurity	150625
Diagnosis/Surgery/Medical Instruments	251872
Information Storage	130840
IOT/Internet of Things	18867
Measuring, Testing and Control Devices	241675
Optics/Photography/Electrophotography	161894
Power Systems	141280
Robotics and Intelligent Manufacturing	39902
Semiconductors/Solid-State Devices/Electronics	319365
Smart Grid/Smart Meters/Energy Infrastructure	4939
Solar/Photovoltaic	15544
Telecom and Other Communications	726811
Virtual/Augmented Reality	21663
Wind Energy	8954

II. Methodology

This study is based on referencing patterns from patents to prior art documents. When an inventor files a patent for an invention, he/she will typically reference earlier documents to show that the new invention either builds upon or improves upon, what came earlier. The inventor’s patent attorney and/or the examiner may also add prior art references to either clarify or limit the claims of the invention.

As an example, Figure 1 shows the front page of a patent owned by IBM. The prior art references on this patent come in two forms - references to earlier patents, and “other

references”. These other references are often to scientific publications, such as those produced by IEEE. In this report, we are primarily concerned with these other references, which are also sometimes called “Non-Patent References”.

It has been suggested that patents with many non-patent references are likely to contain new leading-edge ideas, whereas patents that only reference earlier patents are likely to be incremental improvements on earlier patented technologies. For a comprehensive study on various hypotheses surrounding the motivations of inventors in citing other references, see [1].

Patent Sets used in the Analysis

This study is based on two patent sets. Our analysis is based on determining the number of references from these patent sets to publications from publishers such as IEEE, RELX (formerly Elsevier), the American Institute of Physics, and others.

The first set contains patents from the top 50 patenting companies in 2021. Analysis of this patent set provides an insight into how the top-tier companies rely upon science from IEEE and other publishers. The second set contains all patents in twenty technology categories from all companies, universities, government agencies, and individuals. The twenty technology categories examined are shown in Table 1 above. Analysis of this patent set reveals the wider influence of IEEE science in these technologies.

Identifying Relevant Non-Patent References

Non-patent references can be to any published document, from comic strips and brochures to scientific articles and standards documents. The main difficulty in identifying relevant non-patent references for a study such as this is that inventors do not use a standard form for listing references. As an example, Table 2 contains eight different variants for the IEEE Global Telecom Conference. Note that some inventors just use the GLOBECOM shorthand, while others list the entire name. Sometimes IEEE is mentioned and sometimes it is not. When abbreviation variations are included such as Telecom, Tele, Tcom, Proc., Proceed., the number of variants increases further. The same issue exists for variants in journal names and standards documents. For example, there are more than 30 variant spellings of the journal title *Journal Of Thoracic And Cardiovascular Surgery* including numerous misspellings of thoracic and every conceivable way of abbreviating cardiovascular.

Table 2 – Variants for IEEE Global Telecom Conference

Proceedings of Globecom '96
IEEE Global Telecommunications Conference
GLOBECOM '90:IEEE
Proceedings of IEEE Globecom '94
IEEE GLOBECOM 2007 - IEEE Global Telecommunications Conference
IEEE Globecom, Global Telecommunications Conference, and Exhibition
Proc of the Global Tele Conf, U.S. New York, IEEE

Conference Identification – to identify conference proceedings among the non-patent references, we first identified references containing keywords such as meeting, symposia, conference, etc. We then used parsing software to identify 2-word and 3-word phrases that appear frequently in this set of papers. The full string was identified for these string sub-sequences to identify frequently cited conferences. In this way, we identified the top conferences referenced in the patent sets and standardized the names of these conferences (i.e., all the different variants of a conference were collected under a single name). As an example, Table 2 shows 8 of the 95 variant names for IEEE Globecom which are unified to the name ‘<conf> IEEE Global Telecommunications Conference (GLOBECOM)’ in this report and the underlying analysis database.

We look up each of these conferences on the web to determine who is listed as their primary sponsor. For example, many of the conferences are sponsored by organizations such as IEEE, ACM (Association for Computer Machinery), and ASME (American Society of Mechanical Engineers). Some conferences are jointly sponsored by multiple organizations and this is noted as well.

When we first started identifying conferences in the 2005 report, we looked up the top 100 most referenced conferences to identify the primary sponsors or hosts. In this current report, we track the top 1,500+ conferences which appear under some 20,000 variant names.

Standards Identification – Standards documents are increasingly referenced, and in general they are easy to identify by looking for strings such as ‘standard’ or ‘std’. Once the records containing the standards were located, it is straightforward to identify the organization that produced each standard (ITU, IEEE, ISO, JEDEC, ANSI, etc.). Further, once the standards bodies are identified, we then identify references to other documents that do not specifically list the words ‘standard’ or ‘std.’ The latter step is necessary since some references look like this “ISO/TC97/SC21/N2066” or “IEEE 802.3” without a specific mention of the word “standard.” As a consequence, we also identify other non-standard documents released from these organizations including draft standards and “requests for comments” documents if they are cited by patents.

Journal Identification – identifying and standardizing journal names is a very difficult process because there are so many different journals, and their names can be abbreviated in many different ways. To make the problem more manageable, we base our analysis primarily on the 45,000+ journals covered by the combined databases of ISI/Clarivate, Elsevier/SCOPUS, and 1790 Analytics, LLC. This is not a severe limitation, since these databases include more than 200 IEEE journals, transactions, and magazines, 3,000+ RELX/Elsevier journals, and 1,200 Wiley journals. In addition, we also identify publishers of about 1,000 non-ISI, non-SCOPUS journals if they appear very frequently in the patent references, but do not appear in these databases.

Once restricted to these 45,000+ journals, we used software that transforms journal names into common abbreviations and then implements string matching. Care must be taken with string matching because, for example, searching for “Urology Journal” will also accidentally identify “Neurology Journal”. Similarly, a search for the journal “Science” would accidentally pick up any reference with ‘science’ in the paper title as well as any of the 800+ journals with science in

their titles such as “Game and Wildlife Science”. Our proprietary software for journal identification (along with some human intervention) deals with these problems so that we generate an accurate match between the patent references and 45,000+ journals. After identifying all relevant journals, we then used the Clarivate and SCOPUS databases and web research to identify the publisher of each journal

III. Results

References from Top 50 Patenting Organizations

Table 3 shows the 50 firms that were granted the largest number of US patents in 2021. It should be noted that many of these firms consist of multiple subsidiaries, and these firms patent under many names. (For example, General Electric has patents filed under 316 names, of which only a fraction contain General Electric in the name.) We identified all the subsidiary names for each company to ensure that our patent counts are accurate.

We identified the top 50 patenting firms because we want to understand the extent to which the current technology leaders use IEEE science. Figure 2 shows the 20 publishers of science whose publications are referenced most frequently by the 50 firms shown in Table 3. This figure shows that patents issued to the top 50 firms between 2002 and 2021 reference IEEE papers, conferences, and standards 655,365 times. This is nearly three times as many references as the second-placed publisher RELX/Elsevier.

IEEE receives 25.08% of the science references from the patents of the top 50 companies. The next closest publisher (ACM) has 8.84% of the total. About 1/3 of the 655,000+ patent references to IEEE are to IEEE sponsored conferences.

Table 4 illustrates the reference distribution of IBM, which is the top patent holder in 2021 (and for the past 2 decades). This reference distribution is typical of the top 50 firms. The references from IBM to IEEE are to several different IEEE journals and conferences. In this table, IEEE journals are highlighted in yellow and IEEE conferences are highlighted in orange. The top overall reference is to IP.com which has a technical disclosure database of prior art that is often referenced by companies. IBM also references several internet standards frequently.

Notice that 33 of the top 65 journals and conferences referenced by IBM patents are published or sponsored by IEEE. Fifteen of the top 60 journals and conferences are published or sponsored by ACM. (Six of the fifteen are jointly sponsored between ACM and IEEE.) Since it’s primarily a software services firm, IBM tends to reference ACM much more than most of the top 50 firms, but still, IBM references IEEE nearly twice as often as ACM as seen in Appendix A-11 (68,773 references to IEEE and 37,584 references to ACM.) The reader may notice many references to ‘IEEE Unseparated’ or ‘Misc ACM’ in Table 4. These are articles that reference IEEE or ACM, but the inventor has not given a reference specific enough to identify the proper journal or conference. A few examples can be found in

Table 3 – Top-Patenting Firms in 2021

Rank	Full Parent Name	2021 Patent Count	2002-2021 Patent Count
1	International Business Machines Corp	8,946	126,521
2	Samsung Electronics Co Ltd	8,809	107,122
3	Canon Inc	3,431	62,963
4	Huawei Technologies Company Ltd.	3,000	20,011
5	Dell Technologies Inc	2,951	21,797
6	Intel Corporation	2,824	46,790
7	Taiwan Semiconductor Manufacturing Co.	2,803	24,535
8	Toyota Motor Corp	2,603	26,632
9	Apple Inc	2,554	24,301
10	LG Electronics Inc.	2,529	32,098
11	Sony Corp	2,509	47,123
12	Microsoft Corporation	2,441	43,576
13	Raytheon Co.	2,393	25,117
14	Qualcomm Inc	2,162	30,505
15	BOE Technology Group Ltd	2,146	11,227
16	Amazon.com Inc.	2,110	16,686
17	Alphabet Inc. (Parent of Google)	2,063	26,733
18	Micron Technology Inc.	1,799	27,034
19	Panasonic Corporation	1,675	49,033
20	Ford Motor Co.	1,672	19,057
21	General Electric Company	1,509	33,949
22	Johnson & Johnson	1,489	18,543
23	Ericsson	1,398	19,786
24	Hitachi Ltd	1,366	39,009
25	Hyundai Motor Co.	1,325	11,747
26	Boeing Co. (The)	1,316	15,695
27	Mitsubishi Electric Corp	1,256	19,403
28	Honda Motor Co. Ltd.	1,244	19,248
29	Seiko Epson Corporation	1,233	25,994
30	Kia Motors Corp.	1,212	5,440
31	Meta Platforms Inc.(Formerly Facebook Inc)	1,174	6,880
32	Hon Hai Precision Industry Co. Ltd.(AKA Foxconn)	1,156	39,194
33	Toshiba Corp	1,144	37,913
34	Medtronic Inc	1,141	21,668
35	Denso Corp	1,107	18,269
36	AT&T Inc	1,097	22,802
37	Siemens Aktiengesellschaft	1,057	24,778
38	Fuji Film Holdings Corp	1,050	28,301
39	Bosch (Robert) GmbH	1,019	20,179
40	Saudi Arabian Oil Company (Saudi Aramco)	1,004	5,382
41	HP Inc	987	26,770
42	Cisco Systems Inc.	978	17,727
43	Honeywell International Inc.	972	19,696
44	SK Hynix Inc	967	14,820
45	Texas Instruments Inc	961	19,512
46	NEC Corp	945	20,085
47	Halliburton Co.	915	9,168
48	Koninklijke Philips N.V.	903	19,001
49	LG Chem Ltd.	899	6,629
50	Advanced New Technologies Co. Ltd	828	938

Table 4 – Reference Distribution from IBM Patents 2002-2021

References	Journal/Conference/Standard
14086	IP Com Prior Art Database tech Disclosure
7811	IETF Network Working Group
5801	Misc ACM
4421	IEEE Unseparated
3227	IBM JOURNAL OF RESEARCH AND DEVELOPMENT
3183	IETF Document
3160	NIST Document
3139	IEEE Int Electron Devices Meeting (IEDM)
2691	ACM SIGPLAN Notices
2654	APPLIED PHYSICS LETTERS
2412	Int Conf on Very Large Data Bases (VLDB)
2375	COMMUNICATIONS OF THE ACM
2258	Proceedings of ACM SIGMOD
1774	IEEE tr ELECTRON DEVICES
1597	USENIX Conference Proceedings
1549	Proc ann IEEE ACM int symp on Microarchitecture (MICRO)
1516	JOURNAL OF APPLIED PHYSICS
1506	IEEE/JPN Soc App Phys - symp on VLSI tech
1468	IEEE int conf on Data eng (ICDE)
1450	Proc SPIE
1393	ACM/IEEE int symp on comp Architecture (ISCA)
1390	ACM/IEEE Design Automation conf
1347	Computer (IEEE)
1293	IEEE JOURNAL OF SOLID-STATE CIRCUITS
1262	IEEE ELECTRON DEVICE LETTERS
1235	IBM SYSTEMS JOURNAL
1209	ACM SIGOPS
1152	IEEE tr COMPUTERS
1150	ACM Conference on Human Factors in Computing Systems (CHI)
1067	JOURNAL OF THE ACM
1010	Usenix conf on File and Storage techogies
995	NIST
976	ACM Conf On Architectural Support for prog Languages and Operating sys (A
950	IEEE Misc Conf
938	SCIENCE
927	IEEE int Symp on High Performance Distributed comp
885	comp Architecture News
825	IEEE int symp On High Performance comp Architecture (HPCA)
793	International World Wide Web Conference
789	NANO LETTERS
780	J Vac Sci tech
779	IEEE tr Software eng
765	IEEE Int Conf Acous, Speech, and Sig Proc (ICASSP)
760	IEEE tr comp Aided Design of Integrated Circuits and sys
746	International Conference on Computational Linguistics (COLING)
744	IEEE tr PARALLEL AND DISTRIBUTED SYSTEMS
735	IEEE Proceedings
733	Proceedings ACM SIGCOMM Symp
725	IEEE tr MAGNETICS
719	NATURE
717	IEEE/ACM Int Conf on Software eng (ICSE)
693	IEEE tr KNOWLEDGE AND DATA ENGINEERING
690	IEEE int conf on Distributed comp sys
647	IEEE Electronic Components and tech conf
638	JOURNAL OF THE AMERICAN CHEMICAL SOCIETY
629	IEEE/ACM Proceedings on Supercomputing (SUPERCOMP)
608	ACSA/IEEE ann comp Security app conf (ACSAC)
601	proc IEEE int Solid State Circuits Conf (ISSCC)
596	IEEE tr INFORMATION THEORY
592	Network Working Group RFC
592	PHYSICAL REVIEW LETTERS
569	IEEE/ACM int conf on comp Aided Design (ICCAD)
562	IEEE/ACM International Symposium on Cluster, Cloud, and Grid Computing
544	IEEE Comp Soc comp Vision and Pattern Recognition
534	IEEE Hawaii Int Conf on Sys Sci (HICSS)

Table 5 below. These are relatively complete references; it is not clear why the inventors were not more careful about listing the full journal names.

Table 5 – Examples of References Mapped to “IEEE Unseparated”

Patent	NPR #	NPR Text
05692177	3	Lewis et al. "Hashing for dynamic and static internal tables." IEEE, pp. 45-56 Oct. 1988.
05699518	4	"The Design and Implementation of a Reliable Distributed Operating System--ROSE", Ng, IEEE, pp. 2-11, Apr. 1990.
05699518	5	"A service Platform for Distributed Applications", Popescu-Zeletin et al, IEEE, pp. 11-17, Jul. 1992.
05709219	5	Kotoku, Tetsuo, et al., "Environment Modeling for the Interactive Display (EMID) Used in Telerobotic Systems," IEEE Nov. 3-5 1991, pp. 999-1004.
05709219	6	Kotoku, Tetsuo, "A Predictive Display with Force Feedback and Its Application to Remote Manipulation System with Transmission Time Delay," IEEE Jul. 7-10 1992, pp. 239-246.
05709219	8	Burdea, Grigore, et al., "Distributed Virtual Force Feedback," IEEE May 2, 1993, Atlanta, GA, pp. 25-44.

References from Companies in Twenty Technology Categories

In the previous section, we analyzed the use of IEEE science by the top patenting organizations. Out of all science publishers, IEEE was cited most often by these organizations by a wide margin. However, looking only at the top companies tells an incomplete story. IEEE publishes journals and runs conferences mainly in information technology, electronics, and related areas. It is, therefore, useful to examine the extent to which IEEE science is referenced by all organizations that patent specific technologies and not just by the leading companies.

As mentioned in the methodology section, we identified all patents in the twenty technology categories shown above in Table 1. 1790 Analytics has developed a classification scheme that categorizes all patents into 50 broad technology areas based on International Patent Classes (IPCs) and Cooperative Patent Classes (CPCs) which are assigned to each patent as part of the examination process. This scheme was used to identify all relevant patents for the current analysis.

We examined each of the technology areas separately, and the results are summarized in Figures 3-19. The first category shown (in Figure 3) is Artificial Intelligence (AI). We identified all non-patent references on patents related to this technology issued between 2002 and 2021. We then determined the science publishers responsible for the largest number of these non-patent references. Figure 3 shows the result of this analysis, namely that IEEE science is referenced far more in AI-related patents than science from any other publisher. 33.13% of all science references from these patents go to IEEE journal papers or IEEE sponsored conference papers (the graphs also include standards documents, but most of the references are to journal or conference papers). In second place is the ACM with 10.06% of the references.

AI is currently a very hot area and is often written about in the popular press. The same can be said for Autonomous Vehicles which are shown in Figure 4. Here again, IEEE dominates in references. In this case, almost half (49.64%) of all references are to IEEE in this category. IEEE receives 10 times as many references from autonomous vehicles as second place Elsevier.

Blockchain and Distributed Ledgers is a relatively new category with only a few hundred patents (as opposed to AI which is a much more established category with 10,000+ patents). We see in Figure 5 though that over 44% of all science references from these patents go to IEEE.

Figure 6 covers Broadcasting patents, which is a category we first added in 2015. This category consists of US patents in the IPCs for Broadcast Communication and Pictorial Communication (Television). It would seem that this would be an area that is somewhat tangential to IEEE's core mission. However, IEEE leads in references in this category as well with 31.5%. The International Telecommunications Union is a distant second with 12.02% of all references.

Figures 7 and 8 show referencing patterns from Computer Hardware and Software patents. Here IEEE once again receives far more references than the other publishers. In both cases, ACM is the second most referenced publisher, but it receives about half of the references that papers published by IEEE receive.

Figure 9 shows references in the fast-growing area of Cybersecurity. This is a very hot area with a lot of recent patent growth, and again IEEE leads by a wide margin (28.14% of all references compared to 15.19% for second place ACM).

Figure 10 examines the top referenced publishers in the Medical Device field, which covers devices as well as diagnostic tools and surgical instruments. Here, IEEE is a respectable fourth in an area that is outside its core competency. RELX which has more than 400 journals in the field, such as *Annals of Thoracic Surgery*, and the *Journal of the American College of Cardiology* has a substantial lead with 20.17% of all references. Wiley with 9.79% of references and Wolters Kluwer (parent of Lippincott) with 8.65% of references are just ahead of IEEE's 7.61% of references in the category.

Figure 11 contains the results for the information storage category. In this area, IEEE is particularly dominant. 41.66% of all the science references from patents in information storage are to papers in IEEE journals or conferences. IEEE's 90,479 references in this category are about six times as many as second-place American Institute of Physics (AIP).

Another hot technology area consists of Internet-of-Things patents. As Figure 12 shows, IEEE science is very important to the development of this new and active area of patenting. More than 38% of all science references are to IEEE content. 3GPP (a standards body) is a distant second with 9.73% of all references.

Figure 13 contains the results of patents covering Measuring, Testing, and Control technology. Patents in this category are related to measuring or testing, force, pressure, weight, etc. as well as chemically measuring substances (e.g. measuring CO2 levels). The category also contains control devices since these technologies are often combined. For example, a patent might be

related to a valve that adjusts at a certain pressure or a certain pollution level. Since this type of measuring can be done both mechanically, magnetically, electrically, or chemically, it is not too surprising to see both IEEE and RELX and the Optical and Chemical Societies all near the top of Figure 13. IEEE receives the most references, but the lead is not as dominant as in the Information Technology-related technology areas.

The results for the Optics category can be found in Figure 14. This is another area that is slightly outside the IEEE core. In this case, IEEE is sandwiched between the two major optics societies. The Optical Society of America (OSA) leads with 35,700 science references, IEEE is second with 31,567 and the International Society of Optical Engineering (SPIE) is third with 28,515 references from optics patents.

Figure 15 contains results for the patents related to power generation and transmission. Although this is a non-information technology category, IEEE leads in references in this category as well. 31.46% of science references from patents in this category go to IEEE publications. RELX is second with 21.19% of all US patent references in the category.

Intelligent Manufacturing and Robotics contains patents related to robotics and robotics and control systems related to manufacturing. According to Markets and Markets [8], the service robotics market is projected to reach USD 103.3 billion by 2026 because of a population explosion in service robots that mow lawns, vacuum floors, and manufacture things.

As this industry grows, new innovations will be patented, and from Figure 16 it looks like those innovations will build upon ideas published in IEEE journal articles or presented at IEEE conferences. We see that 38.48% of all science references from patents in this space refer to IEEE published articles. RELX is the second-ranked publisher, but its papers receive only 9.11% of the scientific references. In this category, IEEE has more references than the next 15 publishers combined.

Figure 17 shows that IEEE is also very strong in the Semiconductor category. Here, the inclusion of conferences gives IEEE a substantial boost. Approximately one-third of the references to IEEE is to conference papers. With conferences excluded, IEEE would be about the same level as the American Institute of Physics in terms of science references from semiconductor patents.

The Smart Meter/Smart Grid category covers patents related to improving the power grid as well as for advanced residential electric meters. This is a relatively small category but as we see in Figure 18, the IEEE provides the bulk of the science base with over half of all patent references.

Solar and Photovoltaic energy results are contained in Figure 19. IEEE holds a lead over RELX in this category despite having fewer journal titles. RELX has several strong journals in this category including *Solar Energy Materials and Solar Cells*, *Thin Solid Films*, *Solar Energy*, *Synthetic Metals*, *Journal of Crystal Growth*, *Solar Cells*, plus more than 50 smaller journal titles related to this technology. The references to IEEE science in this category mainly go to the *IEEE Photovoltaic Specialists Conference*, the *IEEE World Conference on Photovoltaic Energy Conversion*, and *IEEE Transactions on Electronic Devices*.

The Telecommunications category is one of the strongest large categories for IEEE. IEEE articles receive more references than the next six publishers, (four of which are standards bodies). Standards are referenced more frequently in telecommunications than in other categories. About 36% of the 1.8 million total references are to standards documents with the other 64% going to journal and conference articles. In terms of standards documents, the 3GPP General Partnership Project, Internet Engineering Task Force, and International Telecommunication Union received the most references in the category. New telecommunications patents are referencing scientific articles to a larger extent than in the past. In last year's report, this figure showed 593,000 references to IEEE articles for the 20 years from 2001-2020. Now as we see in Figure 20, there are more than 668,000 references to IEEE for telecommunications patents in the 20 years 2002-2021.

Standards documents are referenced increasingly often in Telecommunications patents. Six of the top 20 referenced publishers are standards bodies. Moreover, of the 668,000+ references to IEEE, over 65,000 are to various IEEE standards (mostly to the IEEE 802 family of standards).

Virtual and Augmented Reality is another relatively small but hot category. We see in this category that again IEEE leads by a wide margin with 31.62% of all science references from patents. ACM is in second place with 17.99% of references.

Wind Energy is another relatively small area where IEEE has a big lead. We see in Figure 22 that in this area 42.18% of all science references from Wind Energy patents go to IEEE journal and conference papers. This is more than 3.5 times as many references as second place RELX receives, despite having fewer journal titles in the area than RELX does.

Figures 3-22 show aggregate counts of references from all patents in each technology category. Readers who wish to see the firms that reference IEEE publications in each category can consult Appendix B. This appendix contains the 100 organizations that reference IEEE most frequently in each category. Appendix C is similar, except that it contains the organizations that reference IEEE most frequently in the twenty technology categories combined.

Citation Index for Patents Referencing IEEE

In an earlier study (see [2]) it was shown that patents that reference specific IEEE journals perform better on several quality metrics. Moreover, it was shown that the results were statistically significant. In this report, we update a key figure from the previous study showing the citation index of patents that reference IEEE papers versus peer patents that do not reference IEEE.

The citation index is a normalized citation metric that takes the number of citations received by a particular set of patents and divides it by the expected number of citations for patents of the same age and technology class. A random set of patents therefore should have a citation index of 1.0. Research has shown that patents cited by many later patents tend to contain important ideas upon which the later patents are built (see [3] and [6]). Citation indicators are also the basis for the patented financial models (see [4] and [7]) invented by the two 1790 founders Breitzman and Thomas.

Figure 23 contains the Citation Index for the patents in the twenty technology categories that reference IEEE papers and conferences. Also shown is the Citation Index for the set of the remaining patents in each category that do not reference IEEE. Note that the set of all patents in each category has an expected citation index of 1.0. Thus, we see that the patents that reference IEEE are cited sometimes 40% or 50% or higher than expected, while the patents that do not reference IEEE are cited up to 10% less often than expected in some categories. This of course does not imply that all patents that reference IEEE are likely to be more valuable than patents that do not reference IEEE, but it does suggest that in general, patented technologies that build upon IEEE published or sponsored science are more likely to be valuable than patented technologies that do not reference IEEE science.

IV. Conclusions

When a patent is filed, it must reference the prior art upon which it builds, as well as any prior art that limits the claims of the new invention. This study and prior studies show that science published by IEEE forms a significant portion of this prior art for new patents.

In this study, we examined two separate patent sets. The first patent set consisted of patents granted between 2002 and 2021 to 50 organizations with the largest number of US patents granted in 2021. The second patent set consisted of all US patents granted between 2002 and 2021 patents in twenty key technologies: Artificial Intelligence, Autonomous Vehicles, Cybersecurity, and several other categories. In most of these patent sets, IEEE is the dominant source of the non-patent prior art. In other words, IEEE journals and conferences are key outlets for scientific discoveries relevant to cutting-edge technology.

Finally, we analyzed citation indices for IEEE related patents and non-IEEE related patents. These types of metrics have been shown in validation studies to be good markers for the quality, impact, and potential value of patents [3]. In this study, it was shown that patents that build upon IEEE published science tend to have higher citation indices than patents that do not reference IEEE. This suggests but does not guarantee that patents that build upon IEEE science are more likely to become high-quality, high-impact, valuable inventions than patents that do not build upon IEEE.

Specific key results are identified in the Executive Summary.

V. References

- [1] Branstetter, Lee. "Is Academic Science Driving a Surge in Industrial Innovation? Evidence from Patent Citations," Columbia Business School, Discussion Paper #28.
- [2] Breitzman, Anthony. "IEEE and Patents: An Analysis of Patent Referencing to IEEE Papers, Conferences and Standards", 1790 Analytics, LLC, May 23, 2005
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Figure 1: Sample Patent Front Page

United States Patent
Bulzacchelli, et al.

7,822,114
October 26, 2010

Decision feedback equalizer using soft decisions

Abstract

A decision feedback equalizer (DFE) and method include at least two paths. Each path includes the following. An adder is configured to sum an input with a first feedback tap fed back from a different path. A latch is coupled to the adder to receive a summation signal as input. The latch includes a transparent state, and an output of the latch is employed as the first tap in a feedback path to an adder of a different path, wherein a partially resolved first tap in the feedback path is employed during the transparent state to provide a soft decision to supply correction information in advance of a hard decision of the latch.

Inventors: Bulzacchelli; John F. (Yonkers, NY), Friedman; Daniel J. (Sleepy Hollow, NY)
Assignee: International Business Machines Corporation (Armonk, NY)
Appl. No.: 11/761,586
Filed: June 12, 2007

Current U.S. Class: 375/233; 375/229
Current CPC Class: H04L 25/03057 (20130101); H04L 25/067 (20130101)
Current International Class: H03H 7/30 (20060101)
Field of Search: 375/233,229

References Cited

U.S. Patent Documents

7106099	September 2006	Nix
7539243	May 2009	Toifl et al.
2006/0188043	August 2006	Zerbe et al.

Other References

Grozing, "Sampling Receive Equalizer with Bit-Rate Flexible Operation up to 10 Gbit/s," Proceedings of the 32nd European Solid-State Circuits Conference, 2006, ESSCIRC 2006, Sep. 2006 pp. 516-519. cited by examiner.

Kenney, "A parallel architecture for multilevel decision feedback equalization," **IEEE Transactions on Magnetics**, vol. 34, Issue 2, Part 2, Mar. 1998 pp. 588-595. cited by examiner.

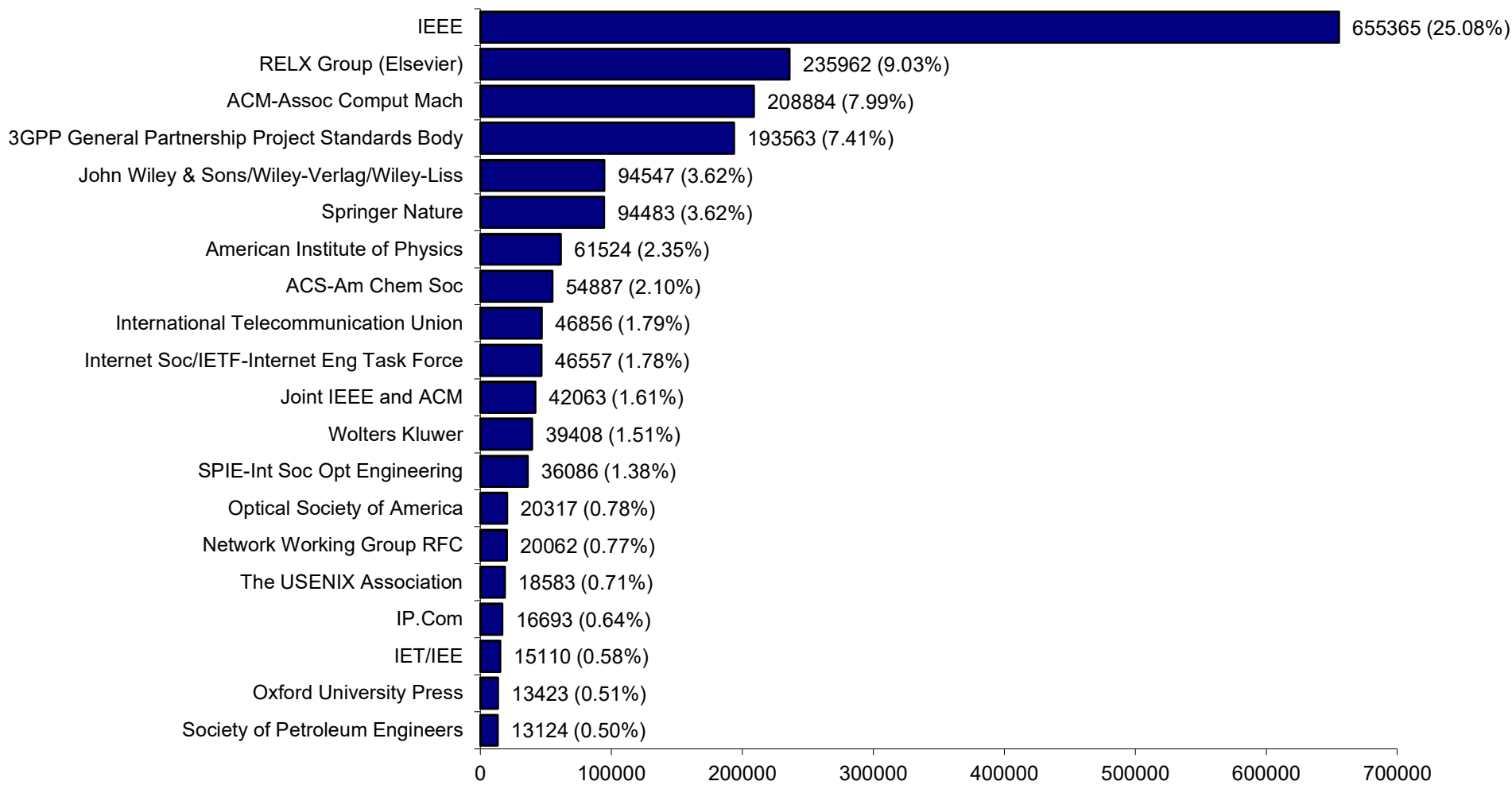
Kenney, "Pipelining for speed doubling in MDFE," 1996 **IEEE International Conference on Communications**, 1996, ICC 96, Conference Record, Converging Technologies for Tomorrow's Applications, vol. 1, Jun. 23-27, 1996 pp. 561-565 vol. 1. cited by examiner.

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Krishna, "A multigigabit backplane transceiver core in 0.13-.mu.m CMOS with a power-efficient equalization architecture," **IEEE Journal of Solid-State Circuits**, pp. 2658-2666, vol. 40, Issue: 12, Dec. 2005. cited by examiner.

Ren, "Performance Analysis of Edge-based DFE", Electrical Performance of Electronic Packaging Oct. 2006 pp. 265-268. cited by examiner.

Figure 2 - # and % of US Patent References from Top 50 Companies to Top 20 Journal Publishers



and % References to Papers/Standards/Conferences from 2002-2021 Patents

Figure 3 - # and % of Science References from 2002-2021 Artificial Intelligence US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

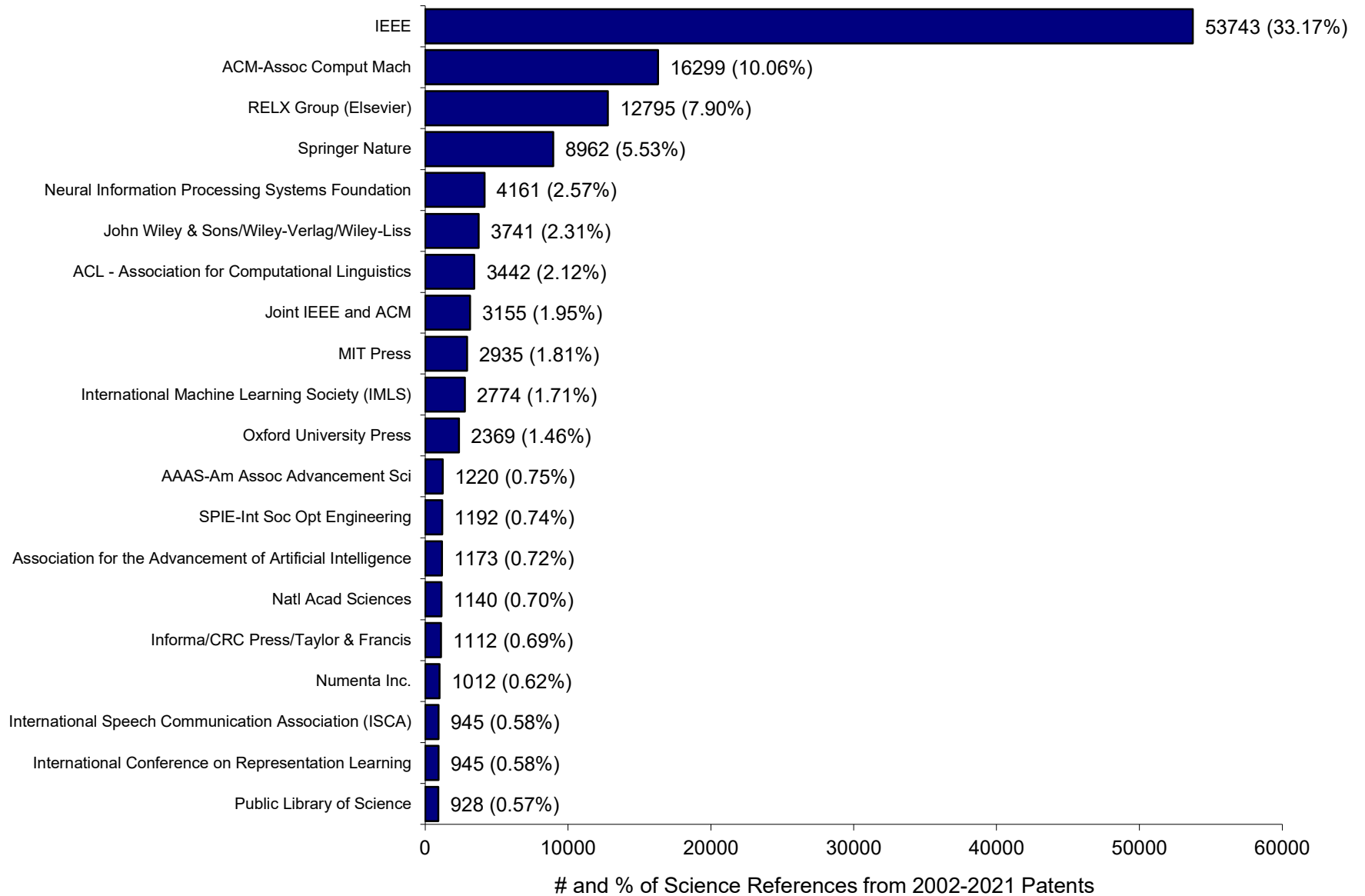


Figure 4 - # and % of Science References from 2002-2021 Autonomous Vehicle US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

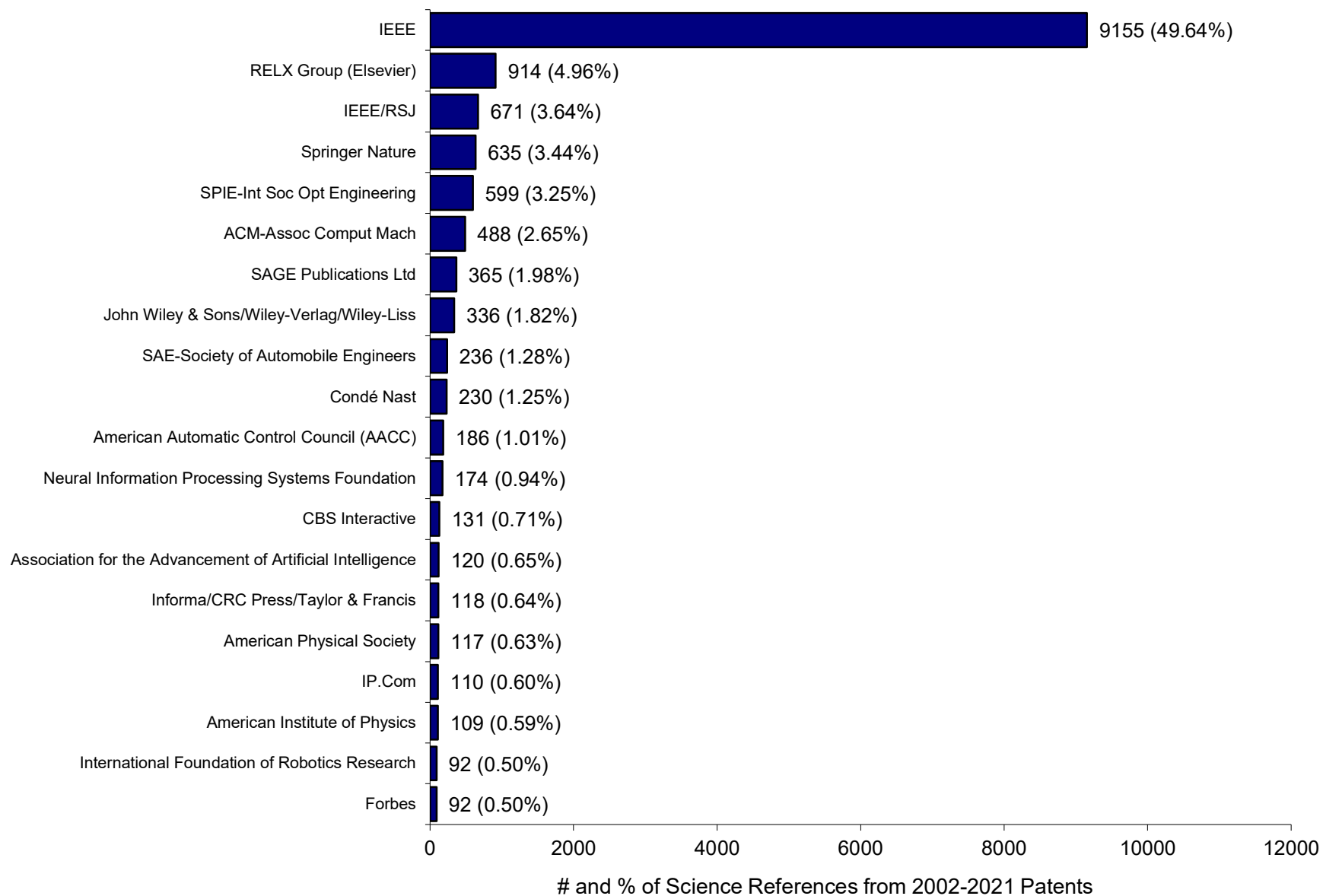
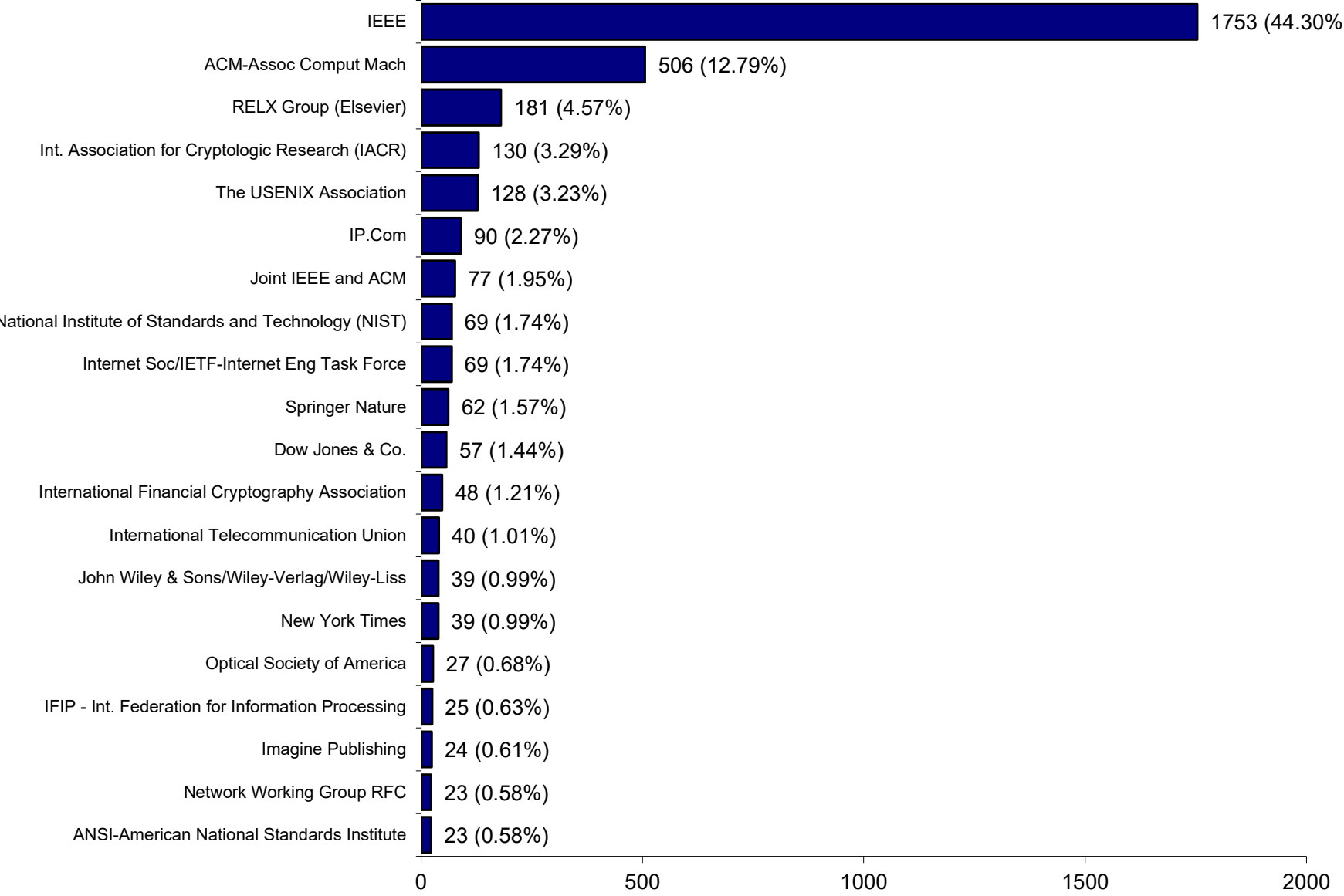
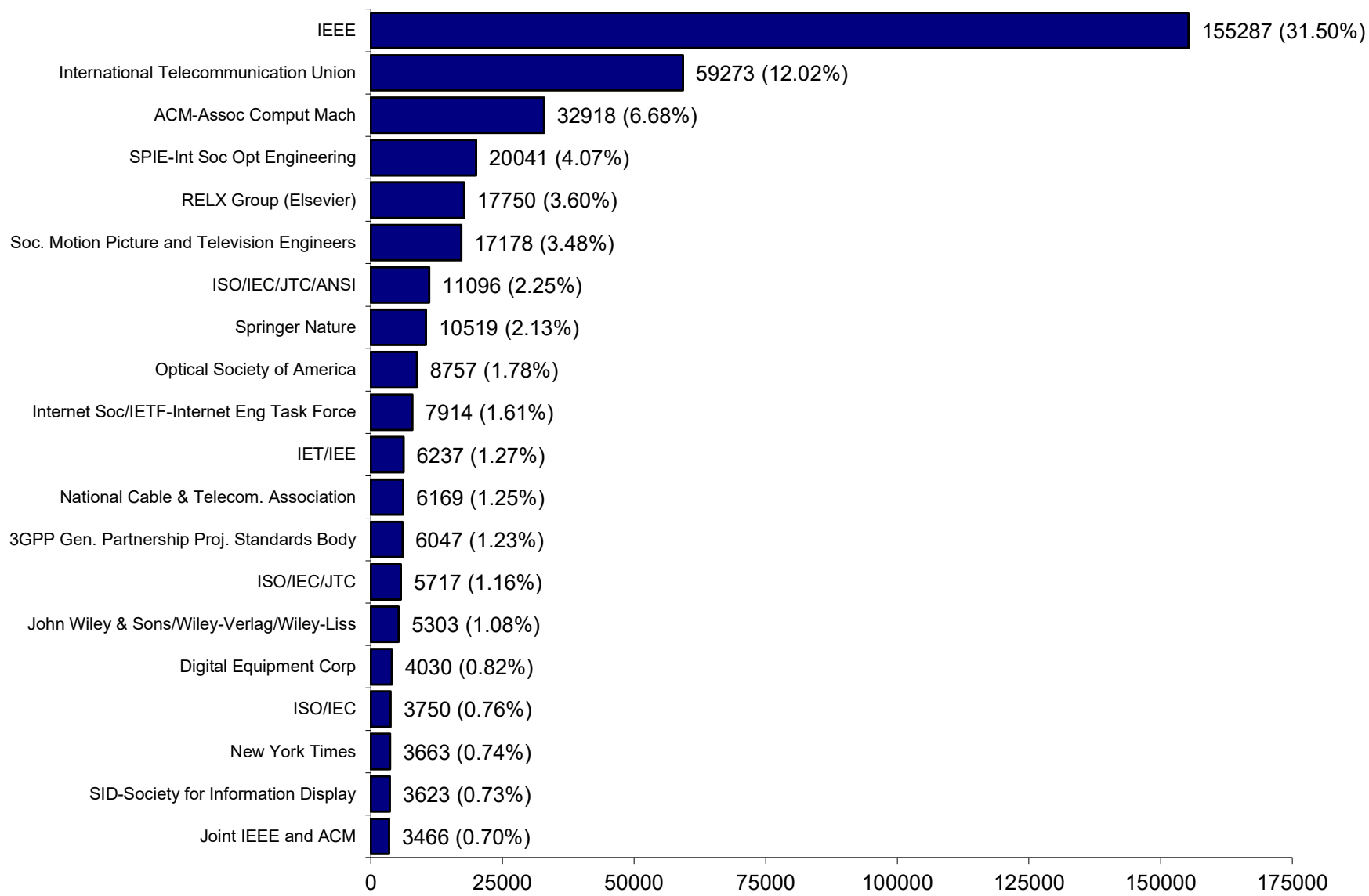


Figure 5 - # and % of Science References from 2002-2021 Blockchain/Distributed Ledger US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



and % of Science References from 2002-2021 Patents

Figure 6: # and % of Science References from 2002-2021 Broadcasting US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



and % of Science References from 2002-2021 Patents

Figure 7 - # and % of Science References from 2002-2021 Computer Hardware US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

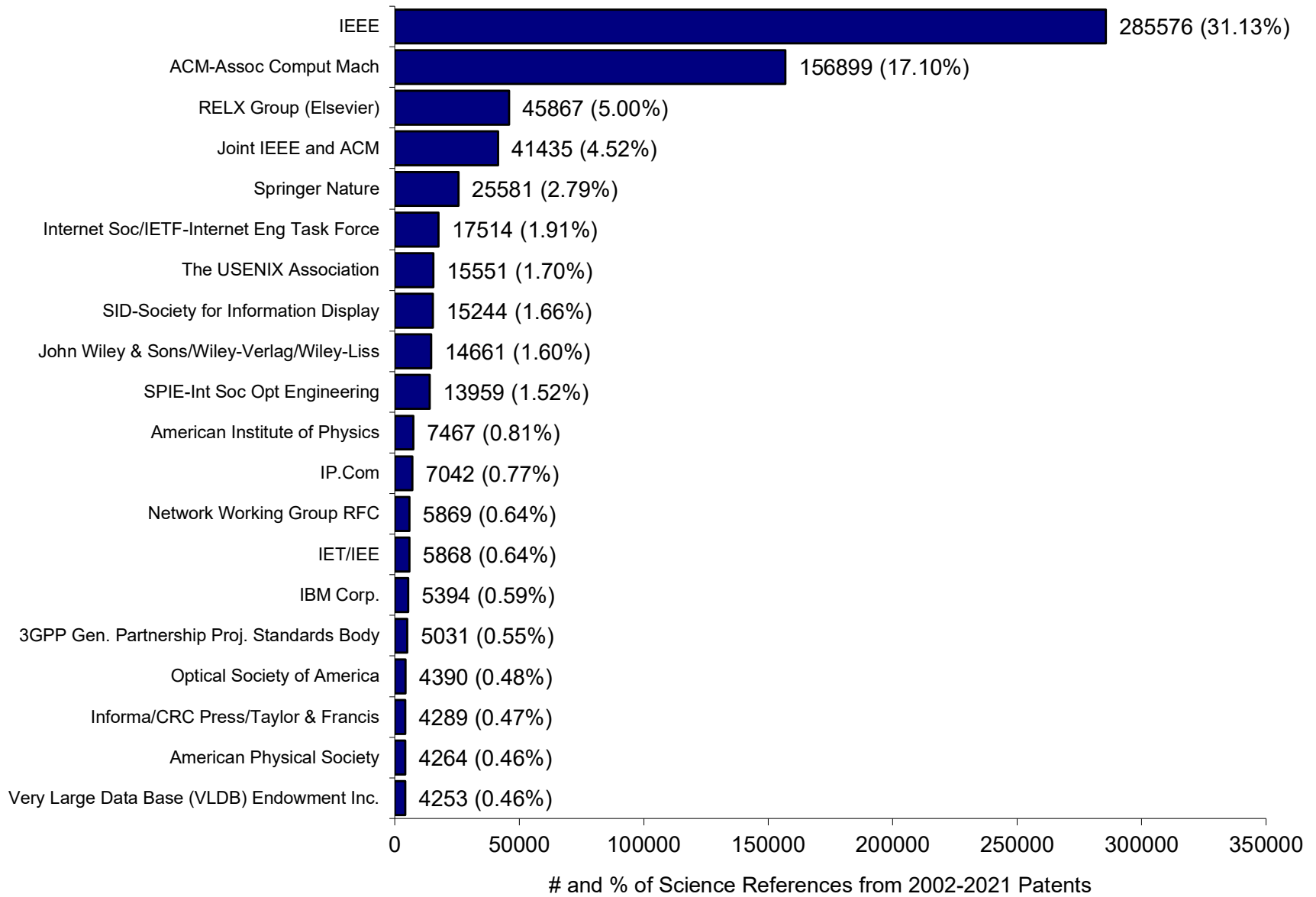


Figure 8 - # and % of Science References from 2002-2021 Computer Software US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

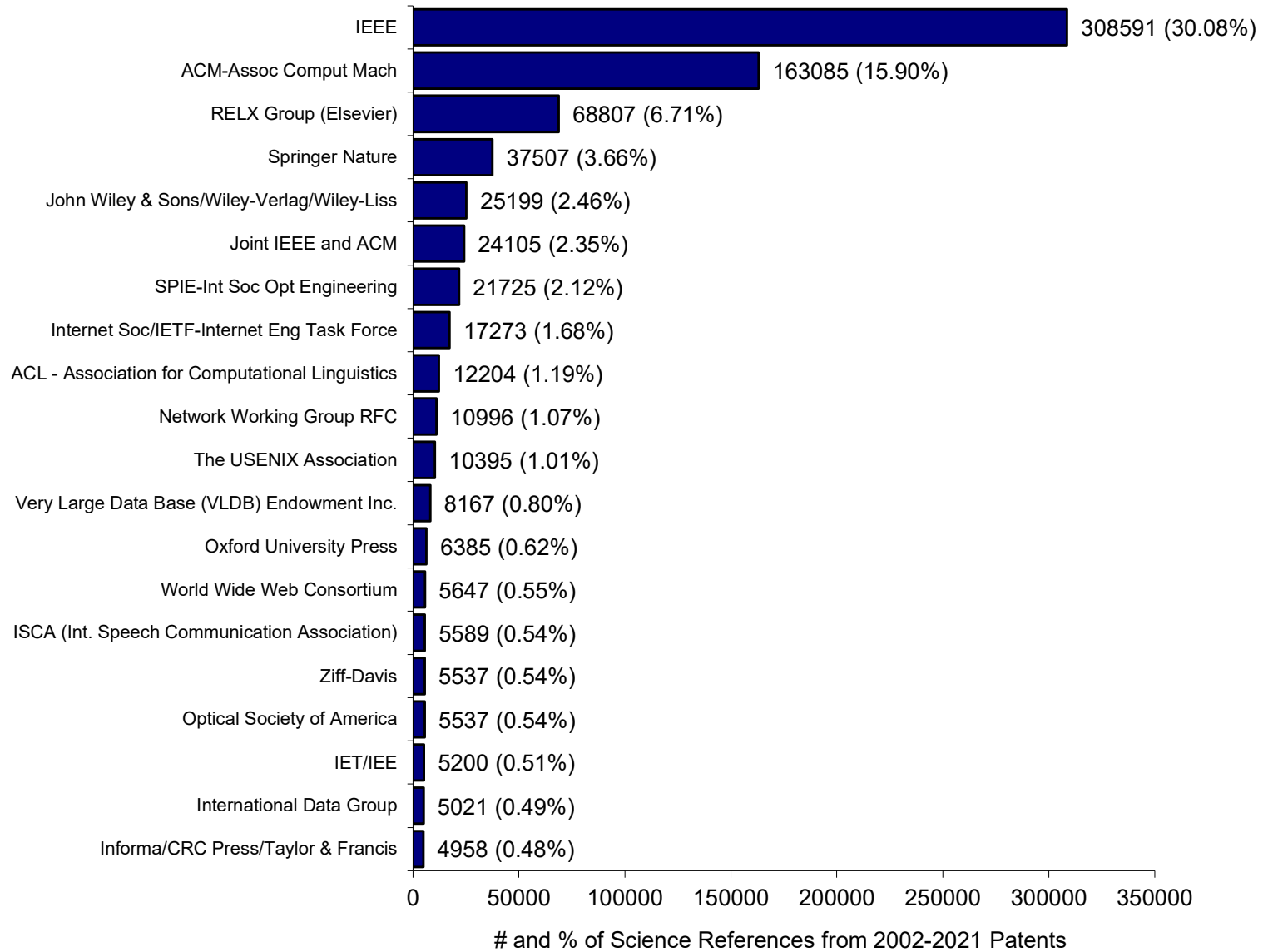


Figure 9 - # and % of Science References from 2002-2021 Cybersecurity US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

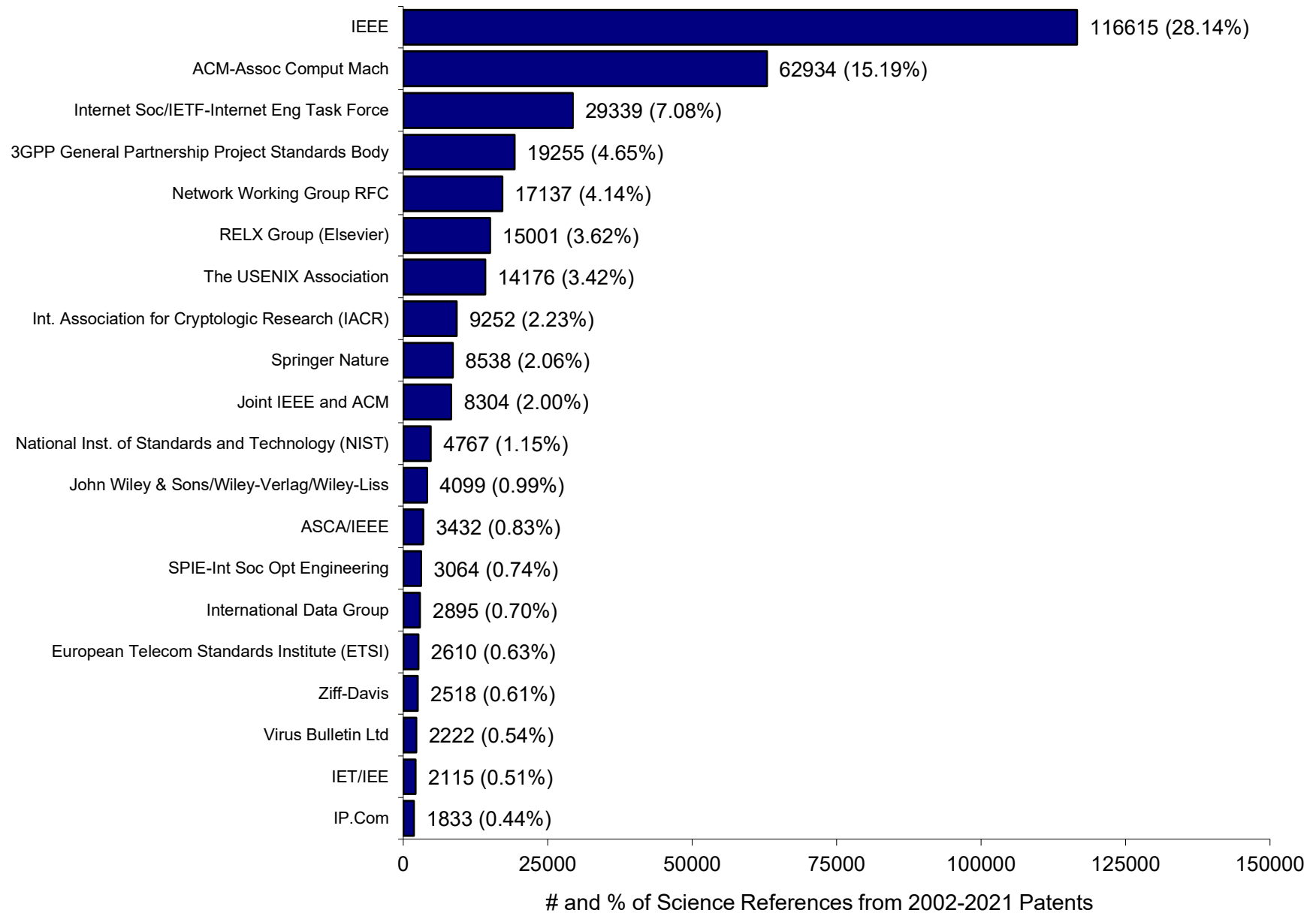


Figure 10 - # and % of Science References from 2002-2021 Medical Device US Patents to Top 20 Publishers and Conference Organizers

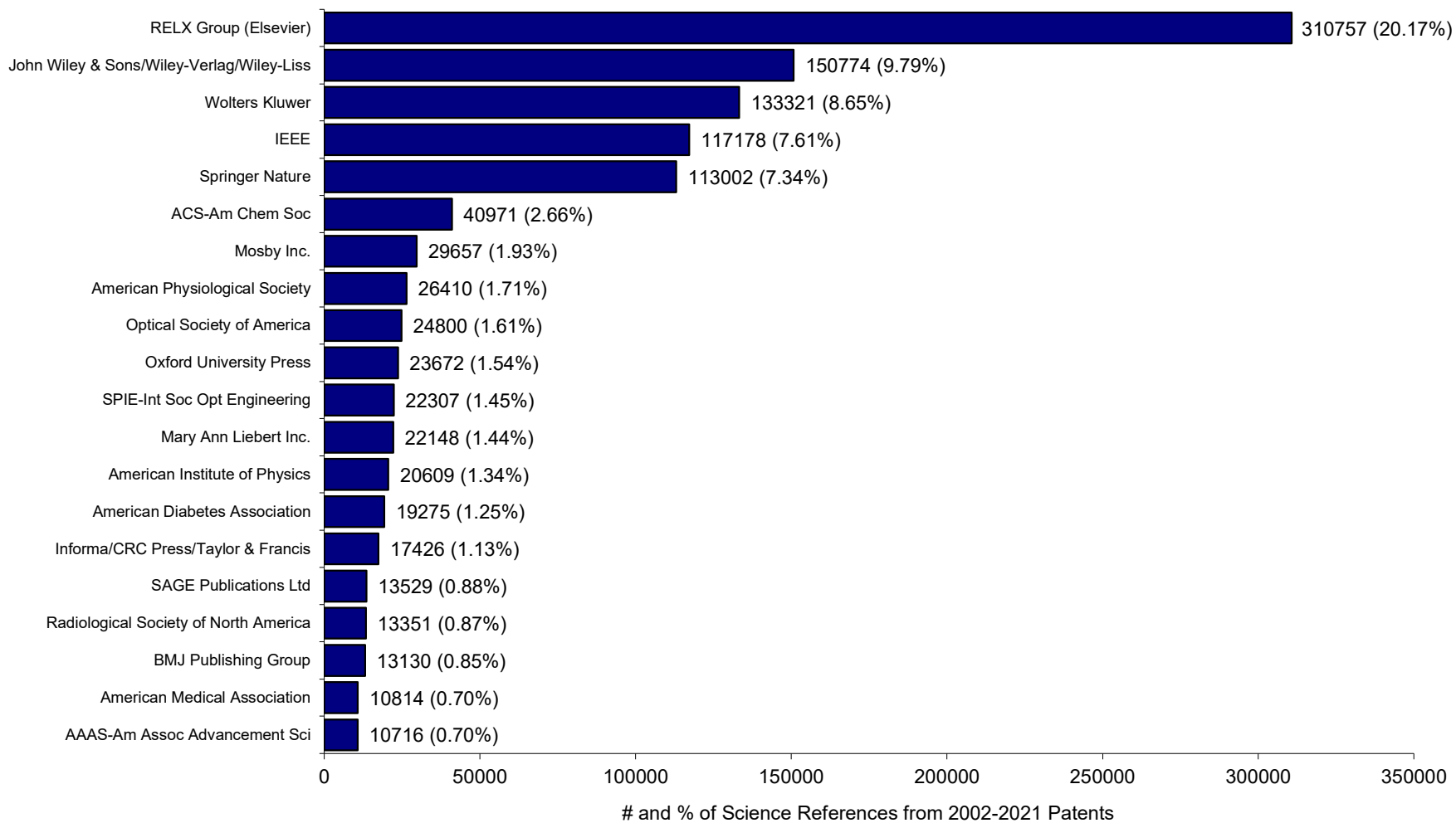


Figure 11 - # and % of Science References from 2002-2021 Information Storage US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

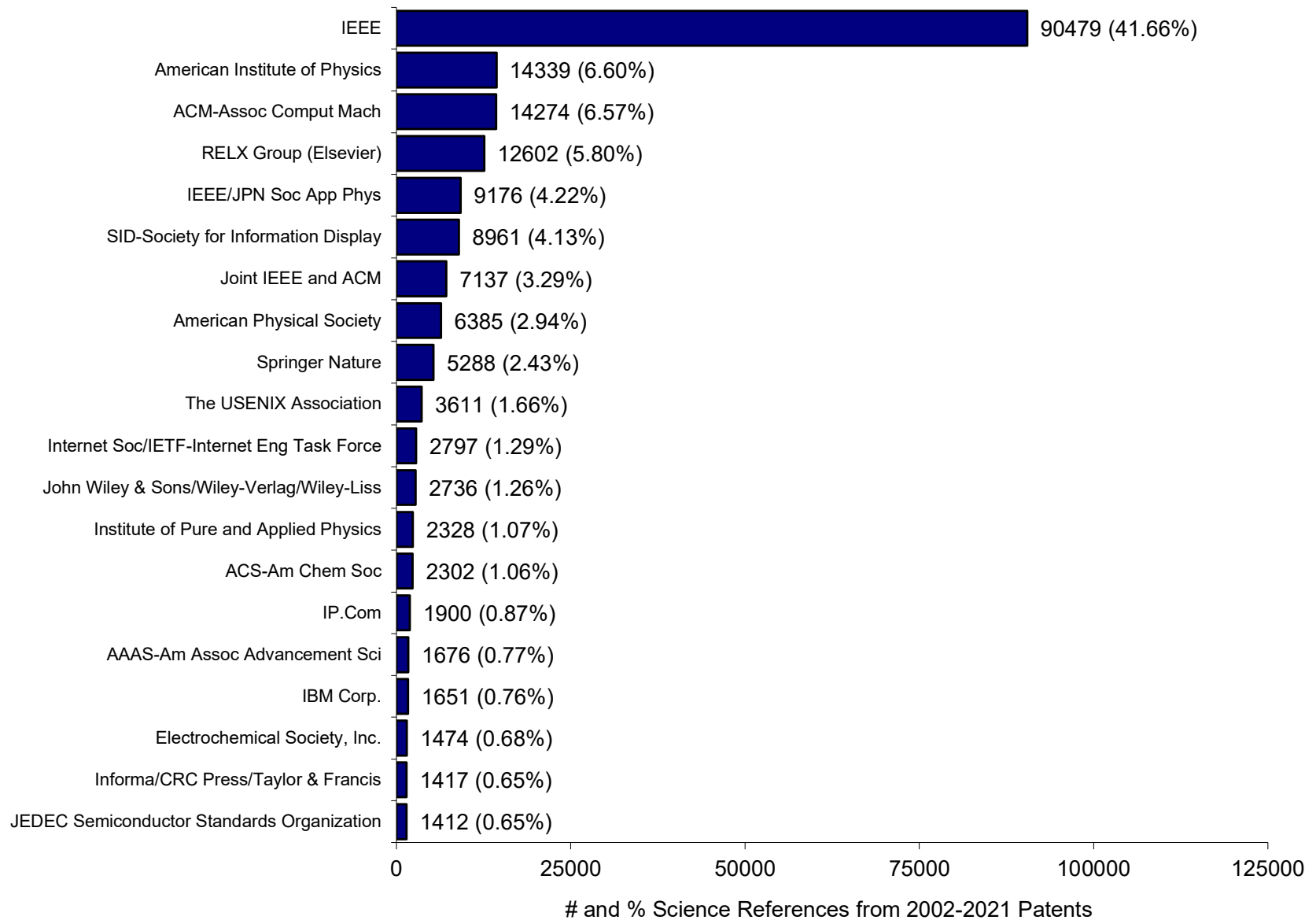


Figure 12 - # and % of Science References from 2002-2021 Internet-Of-Things (IOT) US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

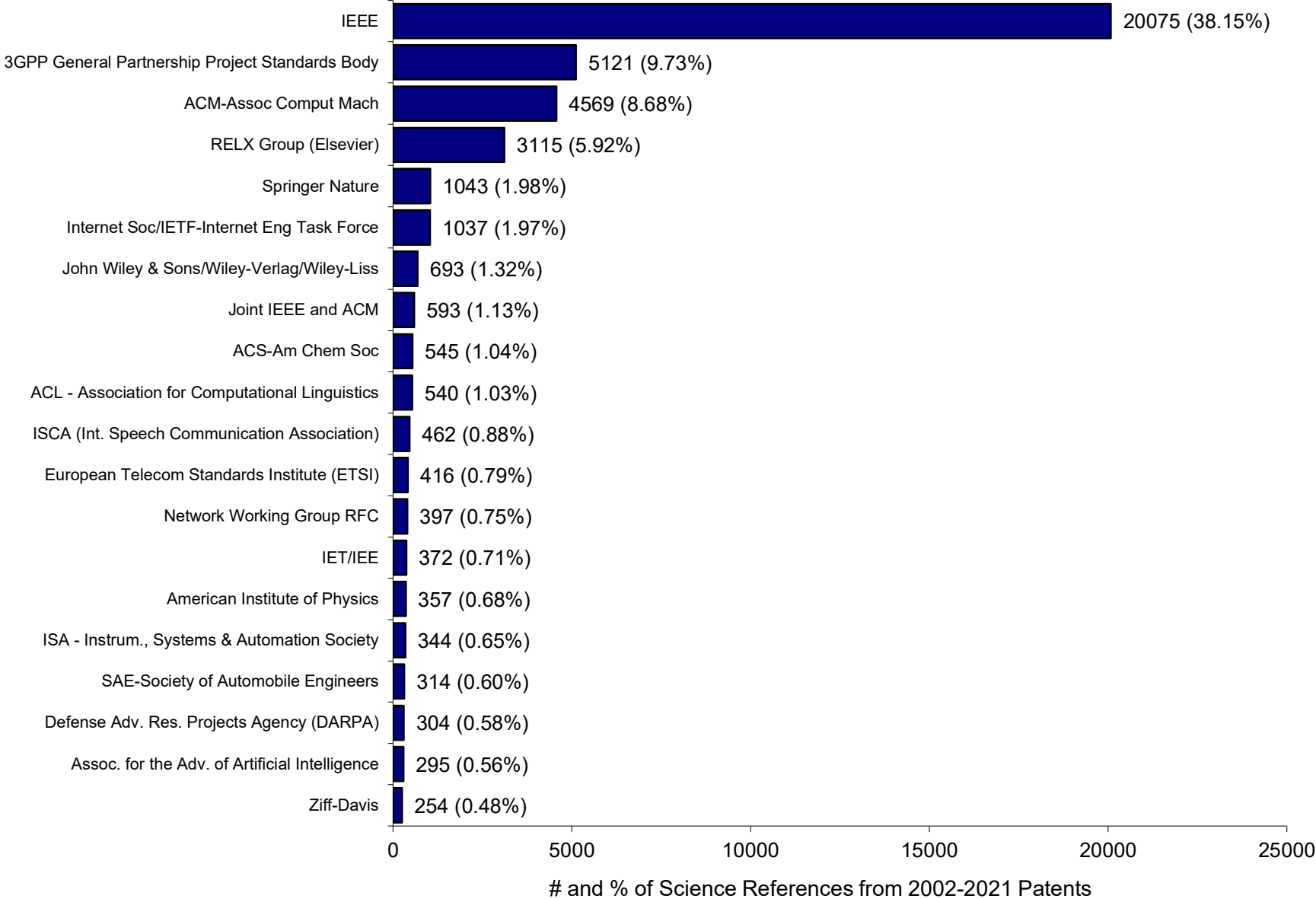


Figure 13 - # and % of Science References from 2002-2021 Measuring/Testing/Control US Patents to Top 20 Publishers and Conference Organizers

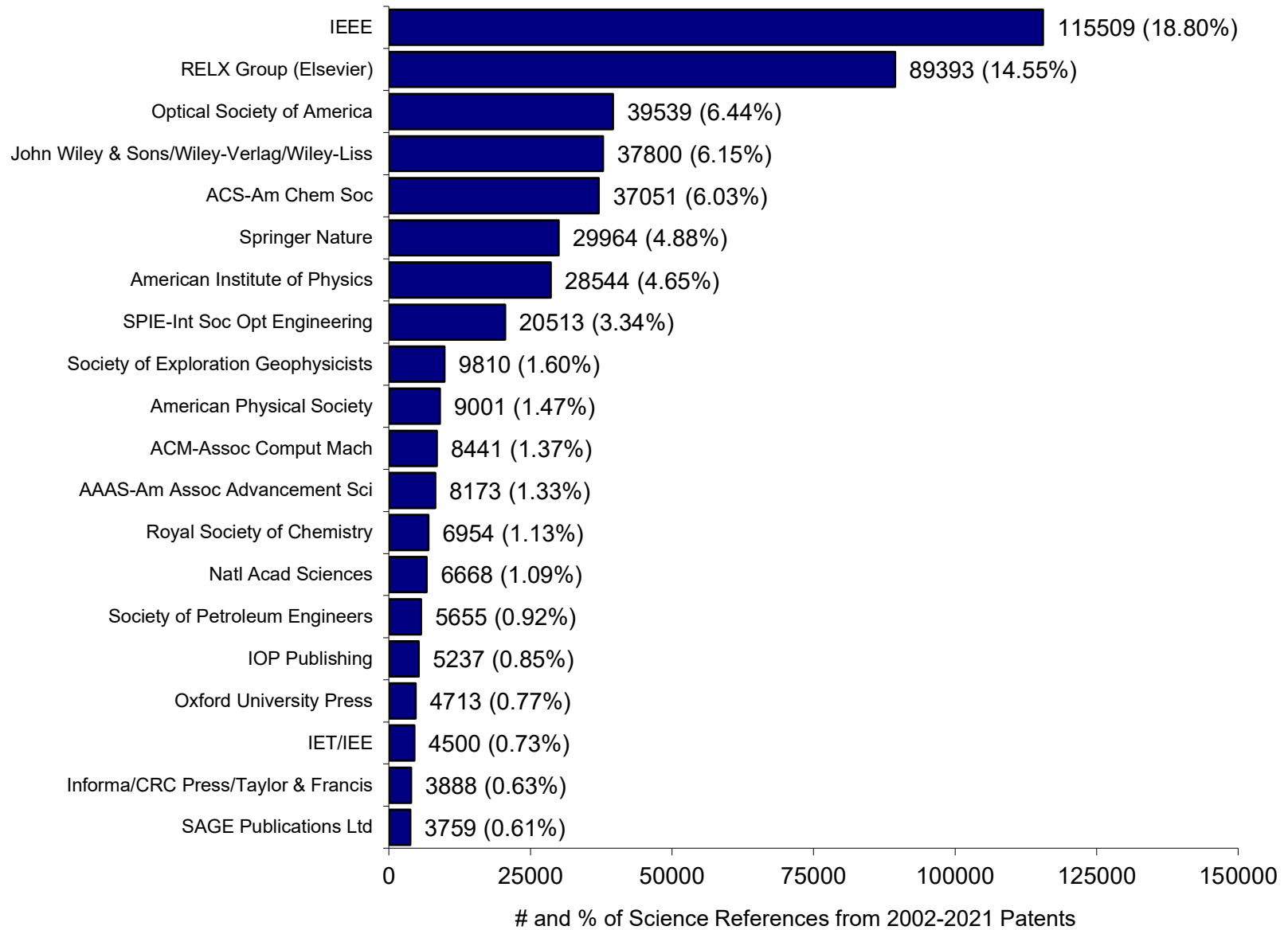


Figure 14 - # and % of Science References from 2002-2021 Optics US Patents to Top 20 Publishers and Conference Organizers

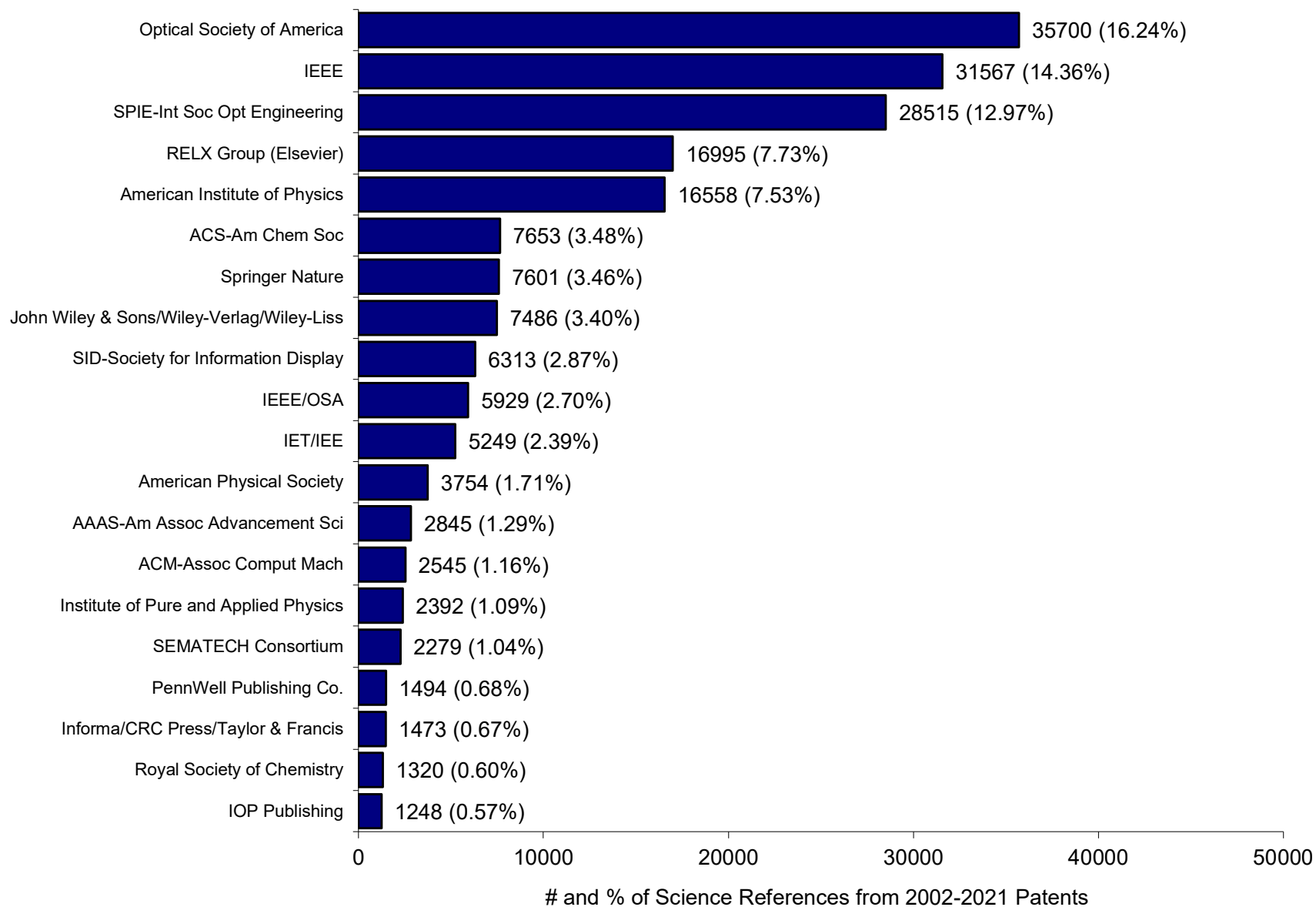


Figure 15 - # and % of Science References from 2002-2021 Power Systems US Patents to Top 20 Publishers and Conference Organizers

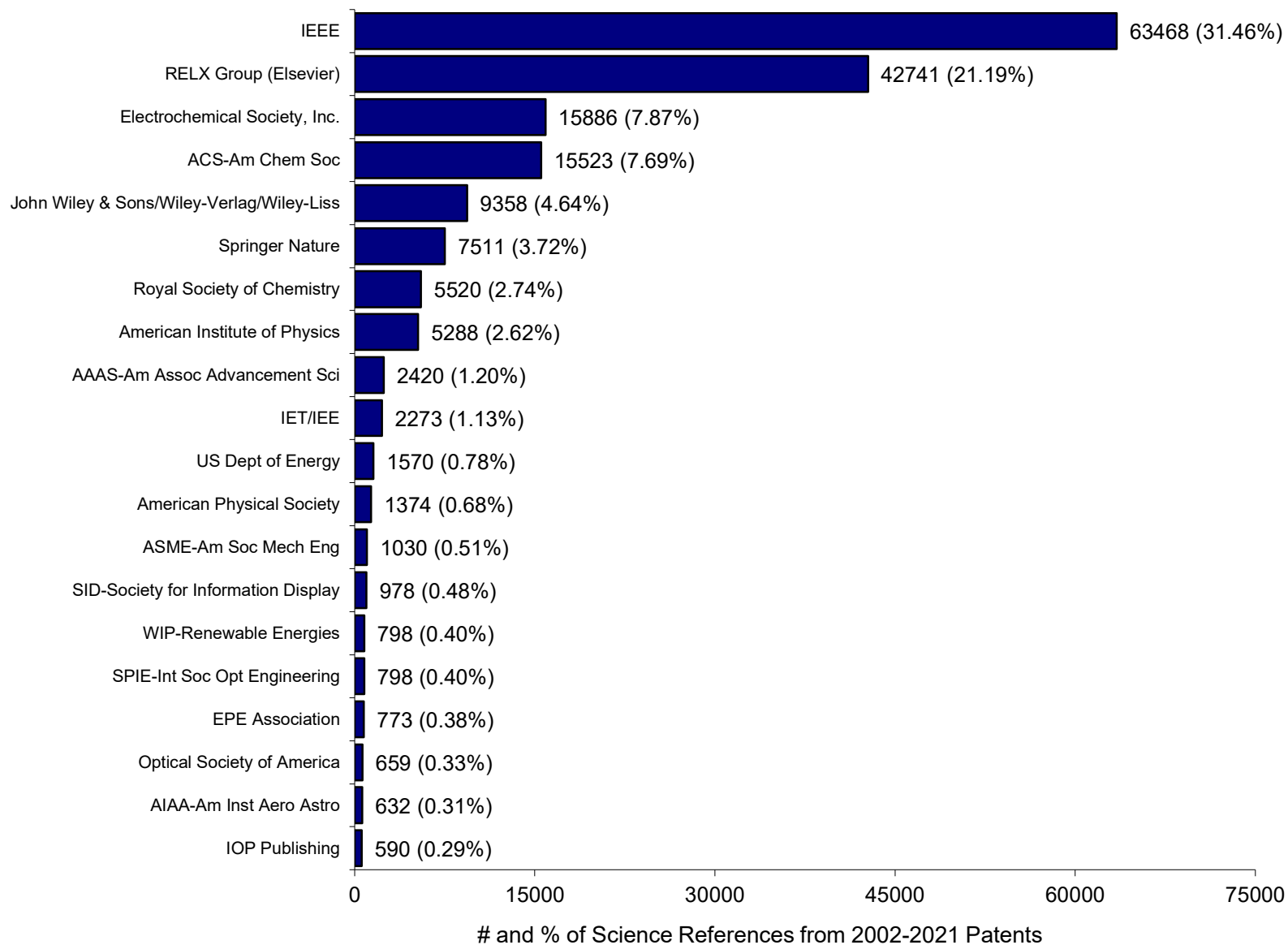


Figure 16 - # and % of Science References from 2002-2021 Robotics and Intelligent Mfg US Patents to Top 20 Publishers and Conference Organizers

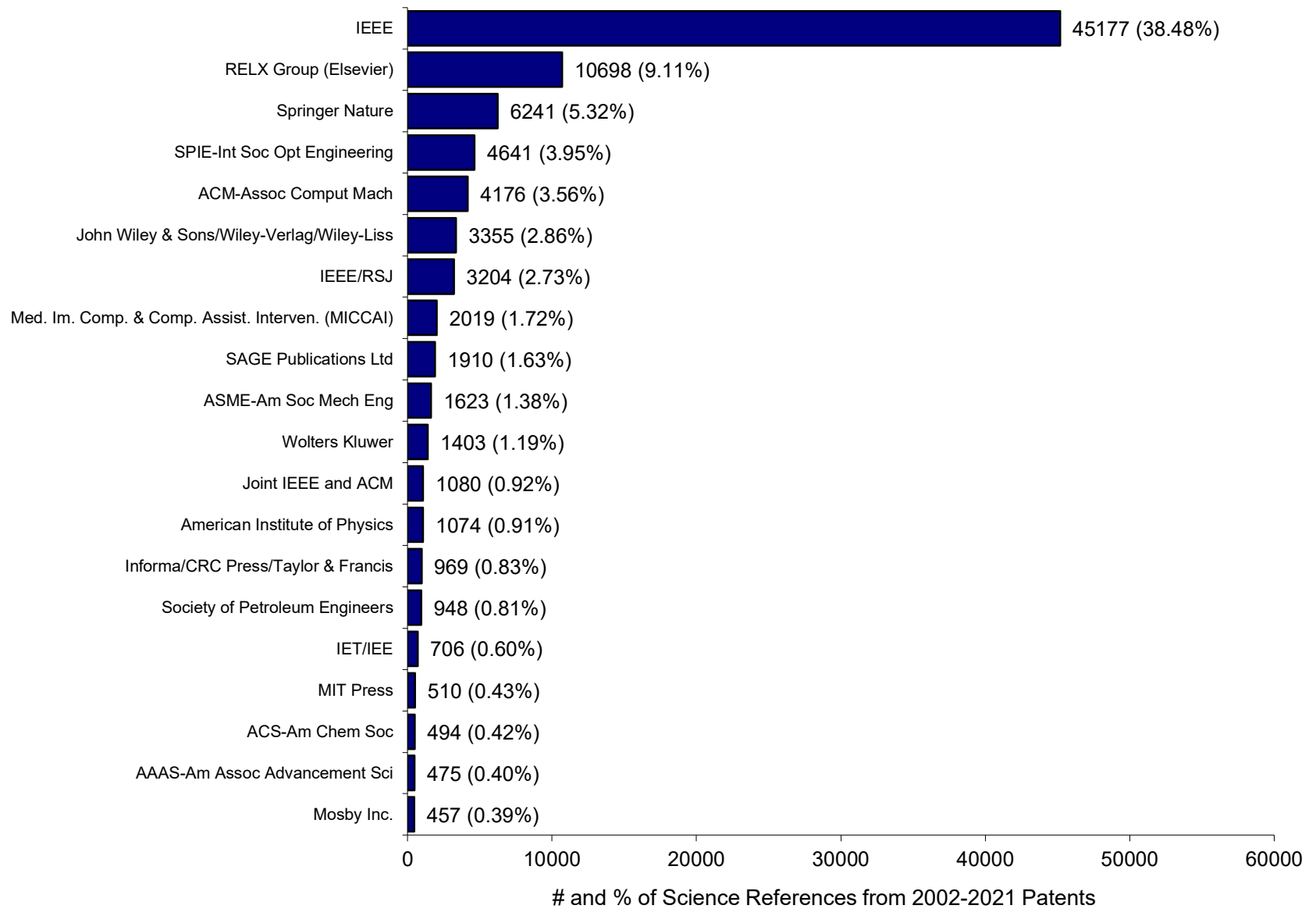


Figure 17 - # and % of Science References from 2002-2021 Semiconductor US Patents to Top 20 Publishers and Conference Organizers

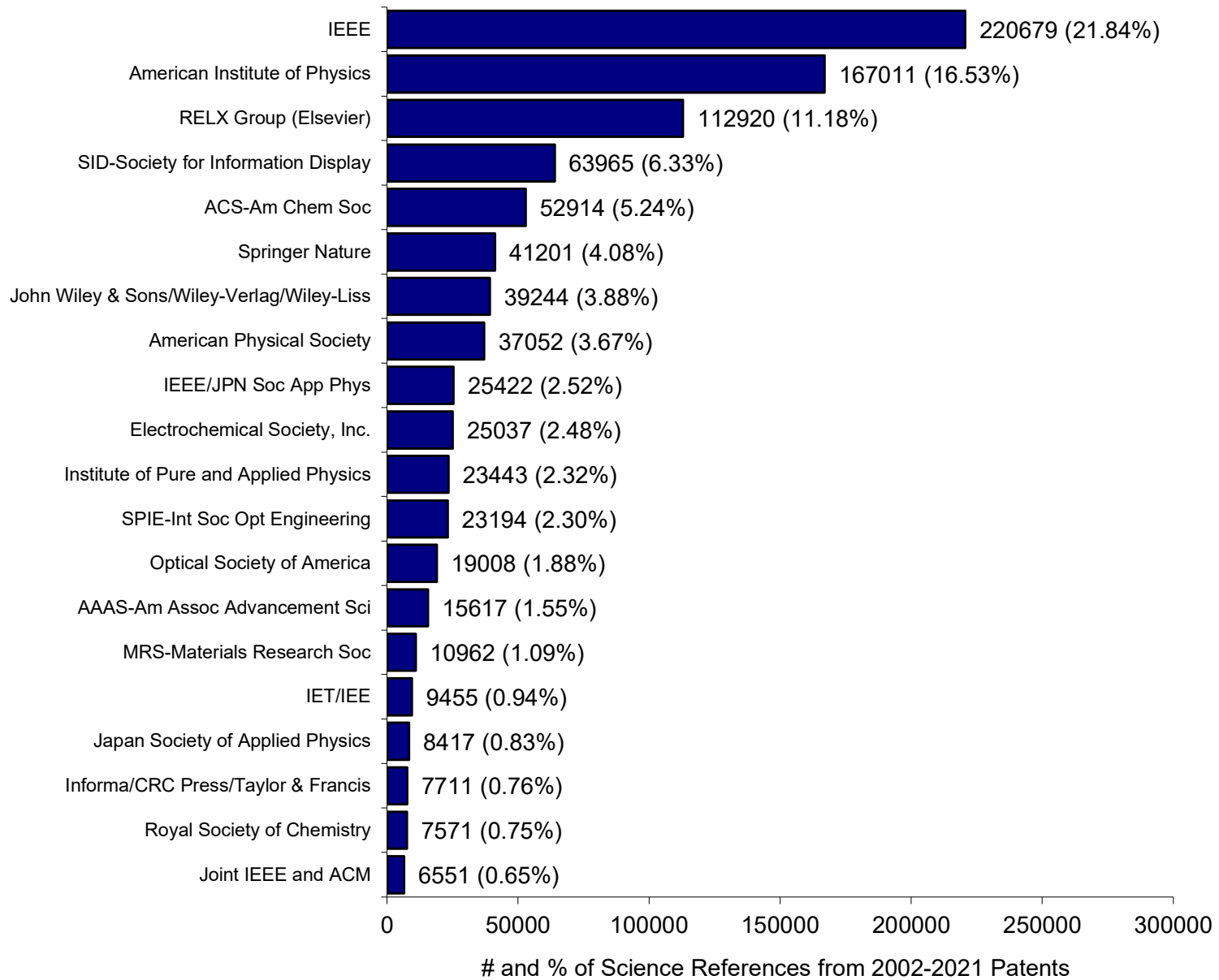


Figure 18 - # and % of Science References from 2002-2021 Smart Meter/Smart Grid US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

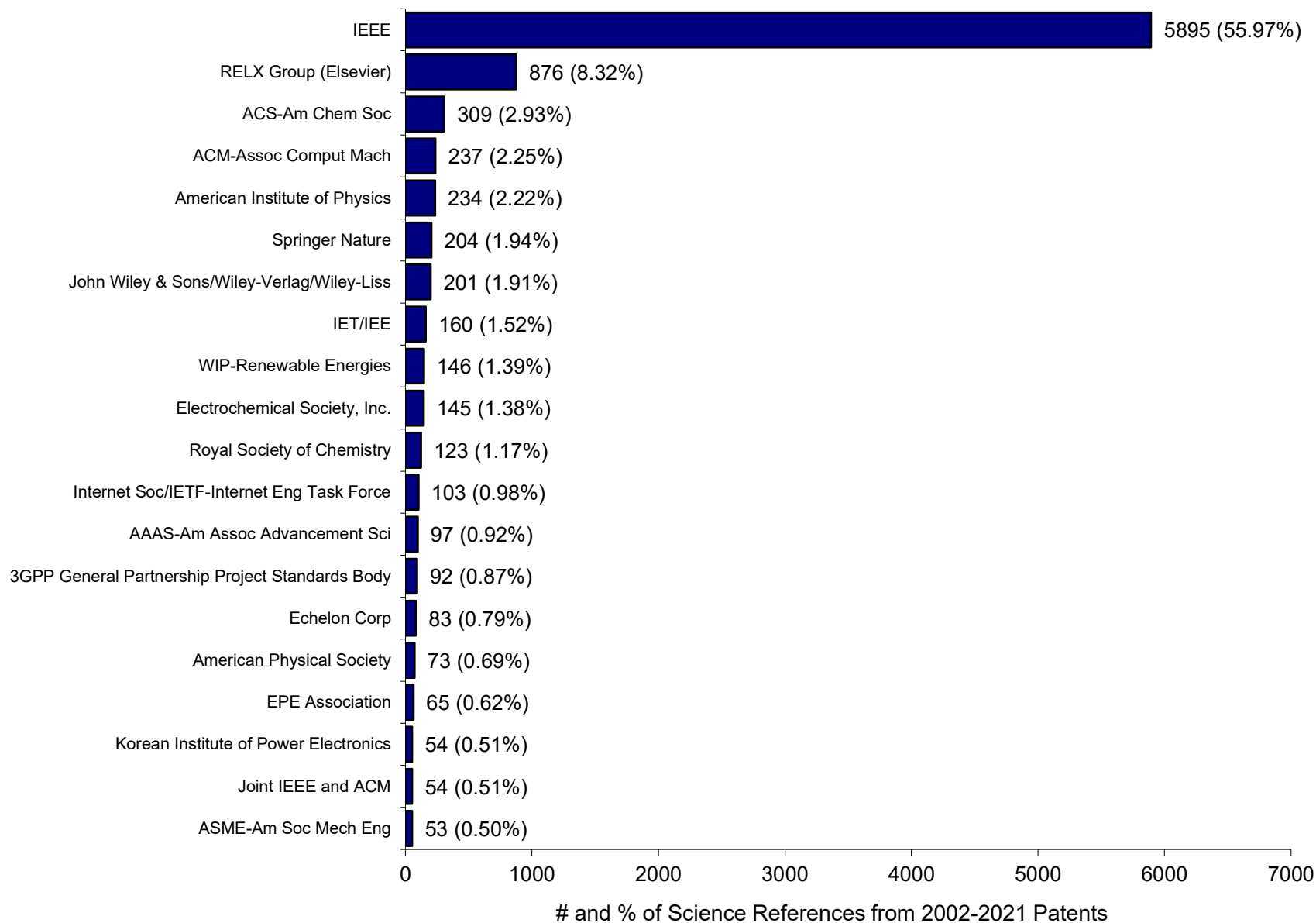


Figure 19 - # and % of Science References from 2002-2021 Solar/Photovoltaic US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

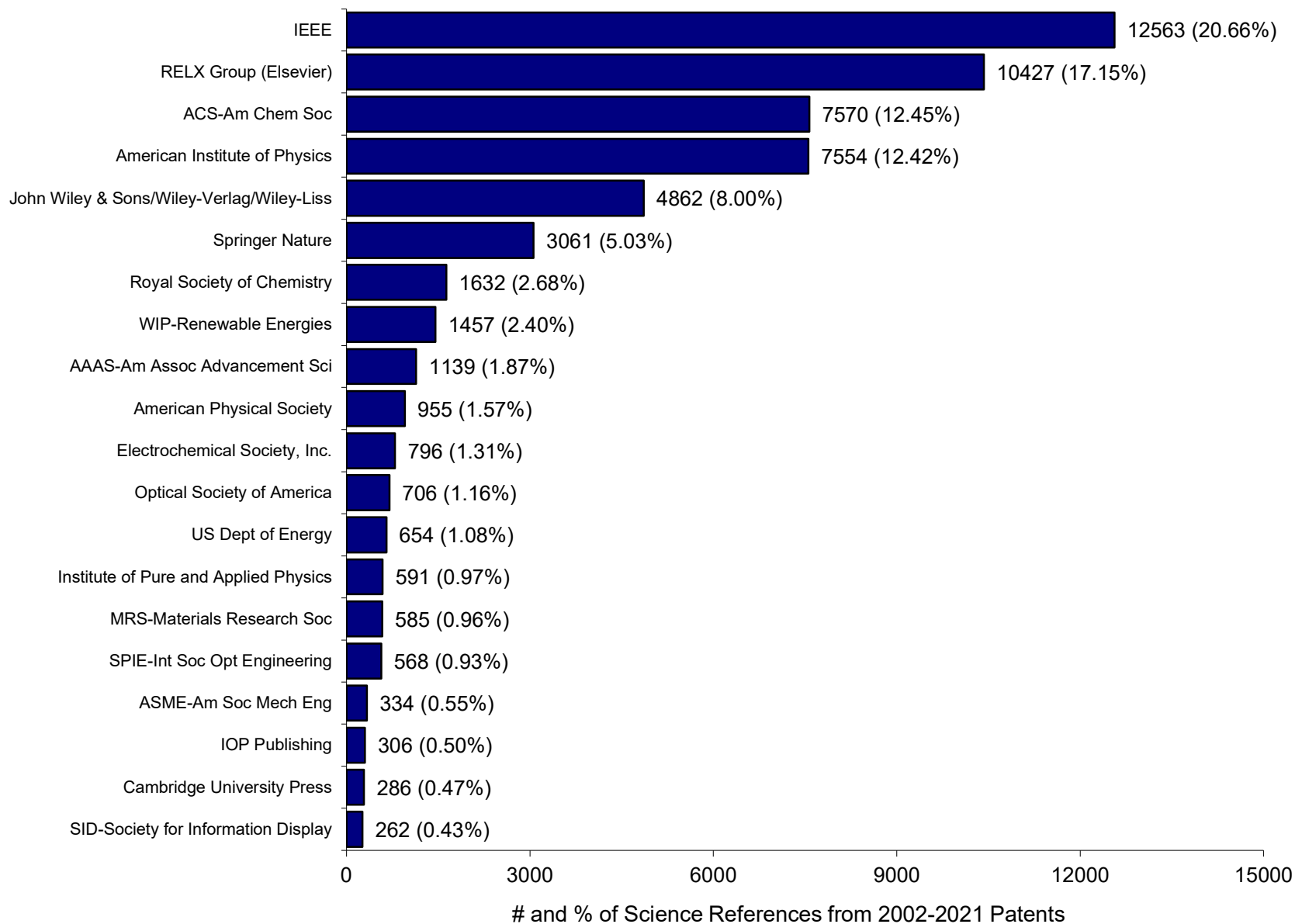
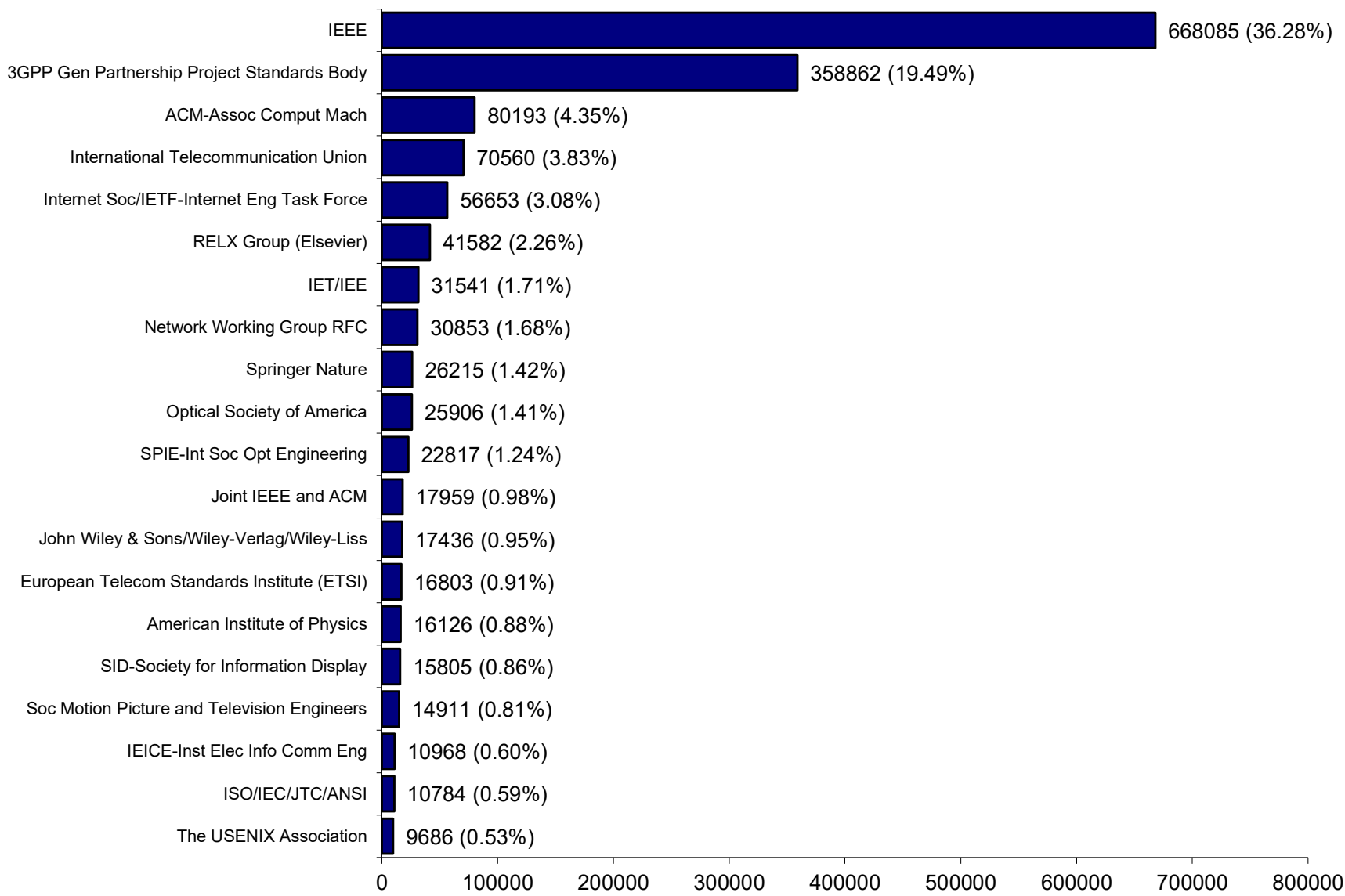
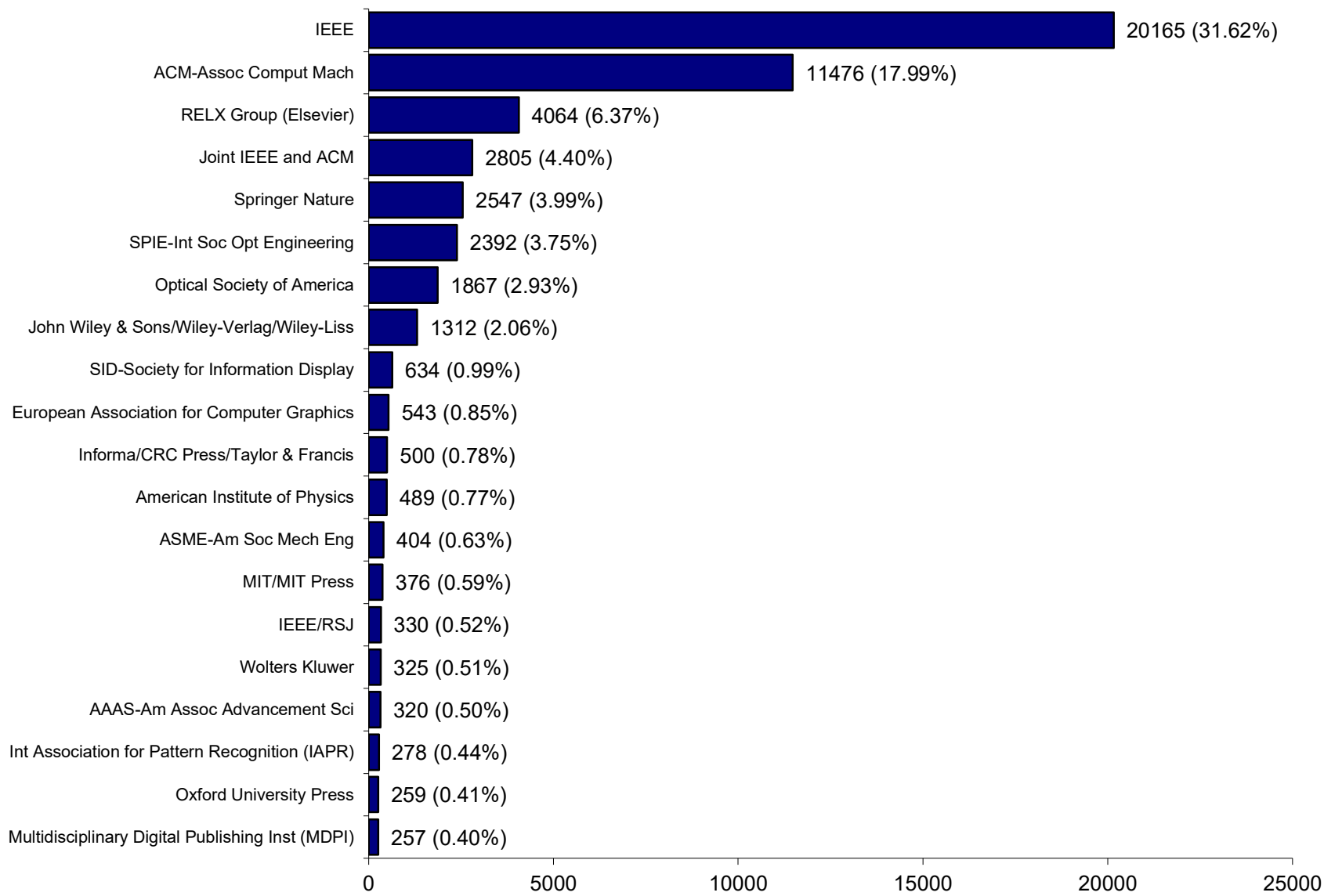


Figure 20 - # and % of Science References from 2002-2021 Telecommunications US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



and % of Science References from 2002-2021 Patents

Figure 21 - # and % of Science References from 2002-2021 Virtual/Augmented Reality US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



and % of Science References from 2002-2021 Patents

Figure 22 - # and % of Science References from 2002-2021 Wind Energy US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

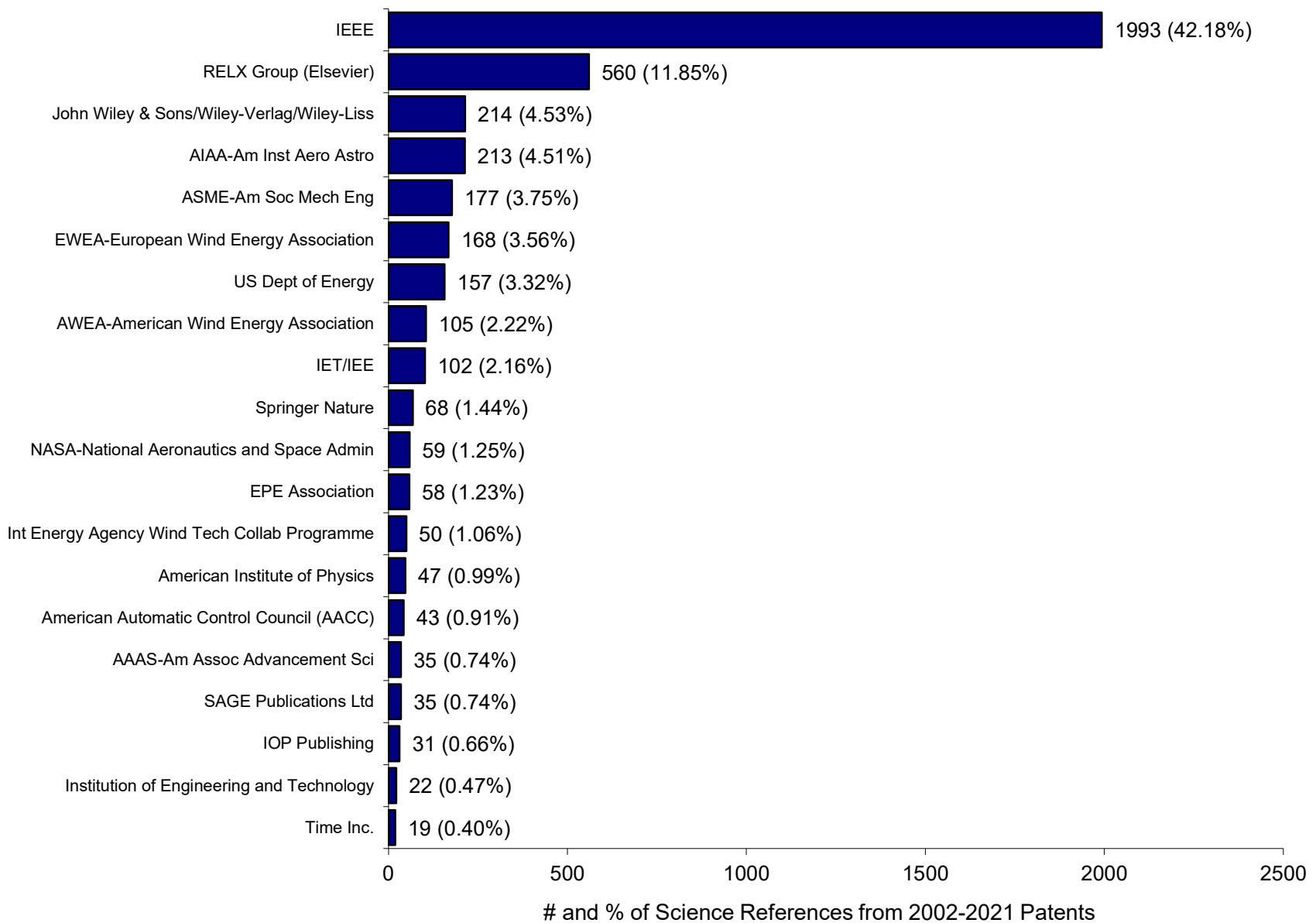
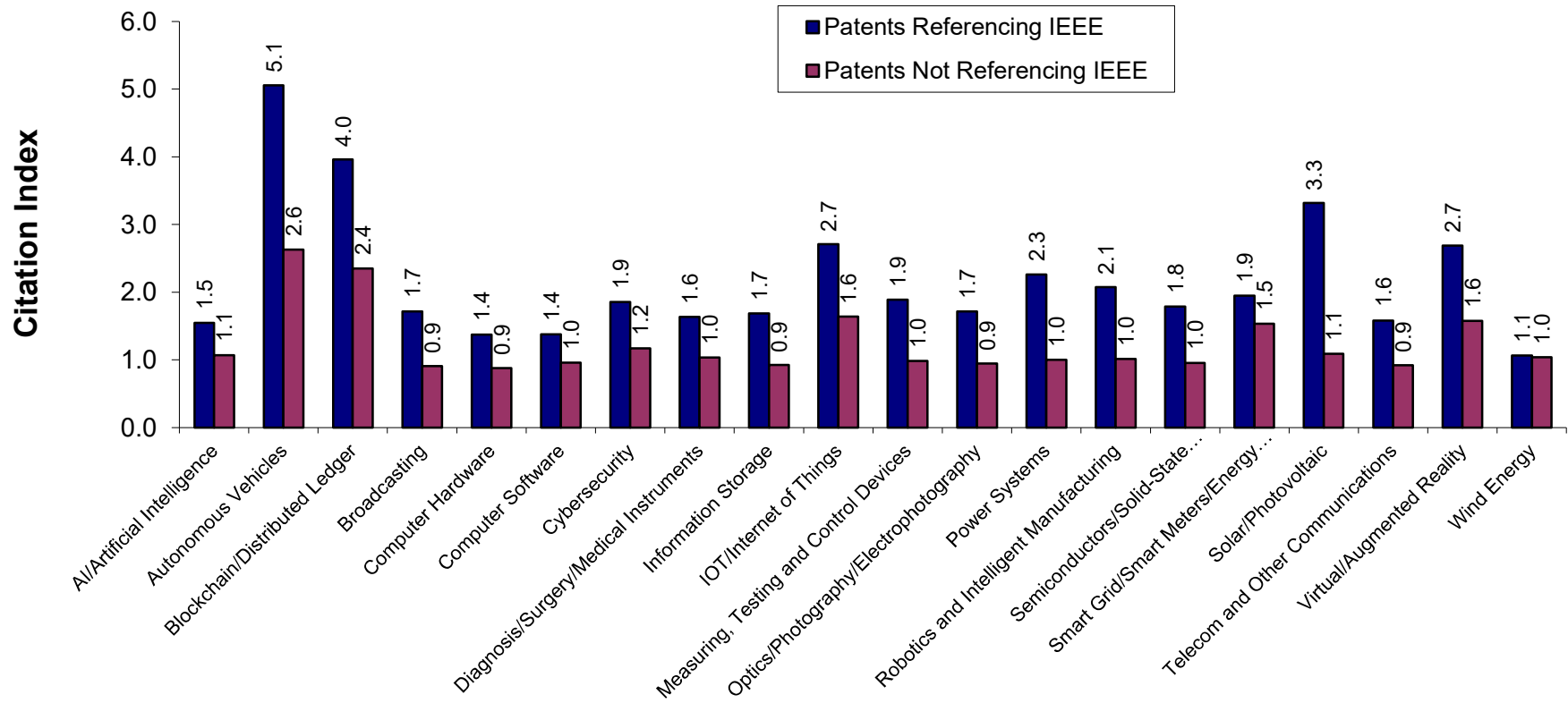


Figure 23 - 2002-2021 Citation Index of US Patents Referencing IEEE Papers and Conferences Versus US Patents not Referencing IEEE for 20 Categories



***Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)***

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Advanced New Technologies Co. Ltd		
IEEE	469	55.1
ACM-Assoc Comput Mach	76	8.9
RELX Group (Elsevier)	44	5.2
The USENIX Association	31	3.6
International Telecommunication Union	25	2.9
International Association for Cryptologic Research (IACR)	23	2.7
IEICE-Inst Elec Info Comm Eng	21	2.5
International Financial Cryptography Association	15	1.8
Springer Nature	15	1.8
Joint IEEE and ACM	12	1.4
Neural Information Processing Systems Foundation	12	1.4
IET/IEE	10	1.2
41 others with less than 1% each	98	10.8

Alphabet Inc. (Parent of Google)

IEEE	27197	31.6
ACM-Assoc Comput Mach	16192	18.8
RELX Group (Elsevier)	4556	5.3
International Telecommunication Union	2980	3.5
Springer Nature	2851	3.3
SPIE-Int Soc Opt Engineering	2391	2.8
3GPP General Partnership Project Standards Body	1867	2.2
Joint IEEE and ACM	1520	1.8
Neural Information Processing Systems Foundation	1404	1.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1352	1.6
ACL - Association for Computational Linguistics	1157	1.3
World Wide Web Consortium	1125	1.3
CBS Interactive	934	1.1
International Machine Learning Society (IMLS)	887	1.0
490 others with less than 1% each	19566	20.1

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>Amazon.com Inc.</i>		
IEEE	7005	27.8
ACM-Assoc Comput Mach	5767	22.9
RELX Group (Elsevier)	1258	5.0
Internet Soc/IETF-Internet Eng Task Force	1071	4.2
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	963	3.8
Joint IEEE and ACM	732	2.9
Information Processing Society of Japan	559	2.2
Springer Nature	504	2.0
The USENIX Association	483	1.9
Network Working Group RFC	392	1.6
International Data Group	389	1.5
Ziff-Davis	326	1.3
CBS Interactive	314	1.2
SPIE-Int Soc Opt Engineering	271	1.1
International Association for Cryptologic Research (IACR)	263	1.0
253 others with less than 1% each	4939	18.1
<i>Apple Inc</i>		
IEEE	48383	33.1
ACM-Assoc Comput Mach	30515	20.9
RELX Group (Elsevier)	7573	5.2
3GPP General Partnership Project Standards Body	3824	2.6
ACL - Association for Computational Linguistics	3604	2.5
ISCA (International Speech Communication Association)	3325	2.3
Springer Nature	2779	1.9
Joint IEEE and ACM	2559	1.8
Association for the Advancement of Artificial Intelligence	2154	1.5
Ziff-Davis	1457	1.0
406 others with less than 1% each	39860	24.9
<i>AT&T Inc</i>		
IEEE	38358	44.7
ACM-Assoc Comput Mach	5335	6.2
RELX Group (Elsevier)	4173	4.9
Optical Society of America	2815	3.3
IET/IEE	2215	2.6
Springer Nature	2016	2.3
3GPP General Partnership Project Standards Body	1699	2.0
American Institute of Physics	1492	1.7
NASA-National Aeronautics and Space Admin	1269	1.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1179	1.4
Internet Soc/IETF-Internet Eng Task Force	1193	1.4
IEEE/OSA	1123	1.3
American Physical Society	1073	1.3
Joint IEEE and ACM	878	1.0
382 others with less than 1% each	21019	23.5

***Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)***

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
BOE Technology Group Ltd		
IEEE	126	15.6
ACS-Am Chem Soc	91	11.2
RELX Group (Elsevier)	91	11.2
American Institute of Physics	76	9.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	74	9.1
Springer Nature	48	5.9
SID-Society for Information Display	38	4.7
China Academic Journal Electronic Publishing House	24	3.0
Royal Society of Chemistry	23	2.8
Optical Society of America	21	2.6
SPIE-Int Soc Opt Engineering	17	2.1
Institute of Pure and Applied Physics	16	2.0
American Physical Society	14	1.7
ACM-Assoc Comput Mach	13	1.6
Informa/CRC Press/Taylor & Francis	11	1.4
Electrochemical Society, Inc.	8	1.0
66 others with less than 1% each	118	13.1

Boeing Co. (The)

IEEE	4593	25.7
RELX Group (Elsevier)	2713	15.2
AIAA-Am Inst Aero Astro	1402	7.8
Springer Nature	637	3.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	622	3.5
American Institute of Physics	624	3.5
SPIE-Int Soc Opt Engineering	588	3.3
ACS-Am Chem Soc	442	2.5
ACM-Assoc Comput Mach	415	2.3
NASA-National Aeronautics and Space Admin	377	2.1
SAE-Society of Automobile Engineers	328	1.8
SAGE Publications Ltd	230	1.3
American Physical Society	219	1.2
ASME-Am Soc Mech Eng	208	1.2
IET/IEE	189	1.1
Optical Society of America	204	1.1
396 others with less than 1% each	4091	20.1

***Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)***

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>Bosch (Robert) GmbH</i>		
IEEE	3008	24.9
RELX Group (Elsevier)	1166	9.7
Springer Nature	884	7.3
American Diabetes Association	365	3.0
Amer Thoracic Soc	351	2.9
ACS-Am Chem Soc	311	2.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	280	2.3
Electrochemical Society, Inc.	265	2.2
SAGE Publications Ltd	216	1.8
ACM-Assoc Comput Mach	209	1.7
SAE-Society of Automobile Engineers	205	1.7
American Medical Informatics Association	194	1.6
Georg Thieme Verlag	188	1.6
Wichtig Publishing	177	1.5
Ziff-Davis	160	1.3
SPIE-Int Soc Opt Engineering	159	1.3
Royal Society of Chemistry	127	1.1
Wolters Kluwer	125	1.0
285 others with less than 1% each	3674	27.8

Canon Inc

IEEE	6818	22.0
RELX Group (Elsevier)	3647	11.8
American Institute of Physics	3340	10.8
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1887	6.1
SPIE-Int Soc Opt Engineering	1669	5.4
ACS-Am Chem Soc	1538	5.0
Springer Nature	1351	4.4
ACM-Assoc Comput Mach	986	3.2
Optical Society of America	900	2.9
International Telecommunication Union	587	1.9
Institute of Pure and Applied Physics	468	1.5
AAAS-Am Assoc Advancement Sci	428	1.4
American Physical Society	312	1.0
470 others with less than 1% each	7049	19.6

***Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)***

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Cisco Systems Inc.		
IEEE	17610	28.3
Internet Soc/IETF-Internet Eng Task Force	9939	16.0
Network Working Group RFC	6776	10.9
ACM-Assoc Comput Mach	6692	10.7
3GPP General Partnership Project Standards Body	4717	7.6
RELX Group (Elsevier)	1709	2.7
Joint IEEE and ACM	1256	2.0
European Telecom Standards Institute (ETSI)	1078	1.7
The USENIX Association	1084	1.7
International Telecommunication Union	794	1.3
Springer Nature	746	1.2
302 others with less than 1% each	9859	13.8
Dell Technologies Inc		
ACM-Assoc Comput Mach	7431	33.0
IEEE	5397	24.0
The USENIX Association	2598	11.6
Internet Soc/IETF-Internet Eng Task Force	1490	6.6
Joint IEEE and ACM	868	3.9
RELX Group (Elsevier)	455	2.0
Springer Nature	346	1.5
Network Working Group RFC	262	1.2
263 others with less than 1% each	3645	13.7
Denso Corp		
IEEE	743	42.0
RELX Group (Elsevier)	168	9.5
American Institute of Physics	73	4.1
ACM-Assoc Comput Mach	60	3.4
Springer Nature	53	3.0
IET/IEE	50	2.8
SAE-Society of Automobile Engineers	48	2.7
ACS-Am Chem Soc	38	2.1
IEICE-Inst Elec Info Comm Eng	37	2.1
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	25	1.4
Trans Tech Publications Ltd.	21	1.2
Joint IEEE and ACM	17	1.0
Institute of Pure and Applied Physics	18	1.0
141 others with less than 1% each	417	26.7

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>Ericsson</i>		
3GPP General Partnership Project Standards Body	27895	45.2
IEEE	15052	24.4
Network Working Group RFC	4777	7.7
Internet Soc/IETF-Internet Eng Task Force	4125	6.7
International Telecommunication Union	1096	1.8
ACM-Assoc Comput Mach	1060	1.7
Optical Society of America	987	1.6
European Telecom Standards Institute (ETSI)	960	1.6
279 others with less than 1% each	5712	7.8
<i>Ford Motor Co.</i>		
SAE-Society of Automobile Engineers	2351	26.9
IEEE	2086	23.9
RELX Group (Elsevier)	1036	11.9
IP.Com	384	4.4
American Automatic Control Council (AACC)	187	2.1
ACM-Assoc Comput Mach	185	2.1
Springer Nature	165	1.9
ACS-Am Chem Soc	166	1.9
IEEE/RSJ	129	1.5
IET/IEE	113	1.3
ASME-Am Soc Mech Eng	99	1.1
Society of Automotive Engineers of Japan, Inc. (JSAE)	90	1.0
224 others with less than 1% each	1737	17.0
<i>Fujifilm Business Innovation Co. (formerly Fuji Film Holdings Corp)</i>		
IEEE	2142	13.5
RELX Group (Elsevier)	2039	12.9
ACM-Assoc Comput Mach	1436	9.1
ACS-Am Chem Soc	1249	7.9
Springer Nature	1079	6.8
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	953	6.0
SPIE-Int Soc Opt Engineering	751	4.7
American Institute of Physics	660	4.2
AAAS-Am Assoc Advancement Sci	251	1.6
Cell Press	245	1.5
Optical Society of America	223	1.4
Natl Acad Sciences	225	1.4
Oxford University Press	177	1.1
Royal Society of Chemistry	169	1.1
American Society of Hematology	156	1.0
445 others with less than 1% each	4101	22.8

***Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)***

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
General Electric Company		
IEEE	10503	18.1
US Dept of Energy	10485	18.1
RELX Group (Elsevier)	7237	12.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	3619	6.2
General Electric Co.	3390	5.8
International Telecommunication Union	2168	3.7
ACS-Am Chem Soc	2056	3.5
Springer Nature	1755	3.0
American Institute of Physics	1380	2.4
ASME-Am Soc Mech Eng	797	1.4
SPIE-Int Soc Opt Engineering	769	1.3
Wolters Kluwer	605	1.0
724 others with less than 1% each	13308	18.2

Halliburton Co. (Holding)

Society of Petroleum Engineers	10540	45.8
RELX Group (Elsevier)	1955	8.5
ACS-Am Chem Soc	1773	7.7
IEEE	853	3.7
SPWLA-Society of Petrophysicists and Well Log Analysts	801	3.5
Society of Exploration Geophysicists	764	3.3
Springer Nature	687	3.0
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	544	2.4
SPIE-Int Soc Opt Engineering	325	1.4
American Institute of Mining and Metallurgical Engineers	309	1.3
PennWell Publishing Co.	304	1.3
Optical Society of America	259	1.1
American Institute of Physics	235	1.0
245 others with less than 1% each	3648	13.7

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Hitachi Ltd		
IEEE	5041	25.4
RELX Group (Elsevier)	1423	7.2
ACM-Assoc Comput Mach	1337	6.7
American Institute of Physics	1214	6.1
IEICE-Inst Elec Info Comm Eng	672	3.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	597	3.0
Internet Soc/IETF-Internet Eng Task Force	557	2.8
Springer Nature	493	2.5
The USENIX Association	414	2.1
ACS-Am Chem Soc	412	2.1
Institute of Pure and Applied Physics	380	1.9
SPIE-Int Soc Opt Engineering	371	1.9
International Telecommunication Union	336	1.7
Network Working Group RFC	338	1.7
Optical Society of America	268	1.4
3GPP General Partnership Project Standards Body	253	1.3
SID-Society for Information Display	254	1.3
Joint IEEE and ACM	247	1.2
Nikkei Business Publications, Inc.	245	1.2
IBM Corp.	231	1.2
IET/IEE	243	1.2
American Physical Society	208	1.0
450 others with less than 1% each	4294	18.5

Hon Hai Precision Industry Co. Ltd. (aka Foxconn)

3GPP General Partnership Project Standards Body	8455	31.6
IEEE	4345	16.3
SID-Society for Information Display	1444	5.4
American Institute of Physics	1383	5.2
RELX Group (Elsevier)	1208	4.5
ACM-Assoc Comput Mach	1083	4.1
International Telecommunication Union	967	3.6
ACS-Am Chem Soc	926	3.5
Springer Nature	573	2.1
SPIE-Int Soc Opt Engineering	506	1.9
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	518	1.9
ISO/IEC/JTC	515	1.9
AAAS-Am Assoc Advancement Sci	491	1.8
American Physical Society	340	1.3
Internet Soc/IETF-Internet Eng Task Force	309	1.2
Institute of Pure and Applied Physics	306	1.1
IEICE-Inst Elec Info Comm Eng	255	1.0
279 others with less than 1% each	3107	8.7

**Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)**

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Honda Motor Co. Ltd.		
IEEE	2775	35.5
RELX Group (Elsevier)	1183	15.2
Springer Nature	471	6.0
ACS-Am Chem Soc	347	4.4
ACM-Assoc Comput Mach	227	2.9
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	213	2.7
IEEE/RSJ	213	2.7
ASME-Am Soc Mech Eng	142	1.8
SAGE Publications Ltd	104	1.3
AAAS-Am Assoc Advancement Sci	95	1.2
SAE-Society of Automobile Engineers	87	1.1
3GPP General Partnership Project Standards Body	79	1.0
260 others with less than 1% each	1871	21.6
Honeywell International Inc.		
IEEE	9807	25.9
RELX Group (Elsevier)	5761	15.2
ACS-Am Chem Soc	3077	8.1
SPIE-Int Soc Opt Engineering	2015	5.3
Springer Nature	1704	4.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1620	4.3
Optical Society of America	1442	3.8
American Institute of Physics	1093	2.9
Royal Society of Chemistry	836	2.2
ACM-Assoc Comput Mach	488	1.3
SAE-Society of Automobile Engineers	372	1.0
549 others with less than 1% each	9636	21.7
HP Inc		
IEEE	7144	30.5
ACM-Assoc Comput Mach	3644	15.6
RELX Group (Elsevier)	1223	5.2
American Institute of Physics	916	3.9
Joint IEEE and ACM	922	3.9
Springer Nature	872	3.7
ACS-Am Chem Soc	573	2.5
SPIE-Int Soc Opt Engineering	590	2.5
The USENIX Association	512	2.2
Internet Soc/IETF-Internet Eng Task Force	478	2.0
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	395	1.7
Optical Society of America	299	1.3
AAAS-Am Assoc Advancement Sci	297	1.3
American Physical Society	315	1.3
416 others with less than 1% each	5206	20.0

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>Huawei Technologies Company Ltd.</i>		
3GPP General Partnership Project Standards Body	27591	46.6
IEEE	14517	24.5
International Telecommunication Union	4431	7.5
Internet Soc/IETF-Internet Eng Task Force	2900	4.9
Network Working Group RFC	1835	3.1
ACM-Assoc Comput Mach	1112	1.9
European Telecom Standards Institute (ETSI)	703	1.2
Optical Society of America	603	1.0
299 others with less than 1% each	5498	7.2
<i>Hyundai Motor Co.</i>		
IEEE	292	28.9
RELX Group (Elsevier)	253	25.0
ACS-Am Chem Soc	75	7.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	39	3.9
ACM-Assoc Comput Mach	37	3.7
SAE-Society of Automobile Engineers	35	3.5
Springer Nature	34	3.4
3GPP General Partnership Project Standards Body	29	2.9
IEEE/RSJ	26	2.6
SAGE Publications Ltd	22	2.2
Royal Society of Chemistry	18	1.8
American Institute of Physics	17	1.7
Electrochemical Society, Inc.	14	1.4
American Automatic Control Council (AACC)	11	1.1
61 others with less than 1% each	109	10.9
<i>Intel Corporation</i>		
IEEE	36705	43.8
3GPP General Partnership Project Standards Body	10004	11.9
ACM-Assoc Comput Mach	6463	7.7
Joint IEEE and ACM	5525	6.6
RELX Group (Elsevier)	2381	2.8
American Institute of Physics	1788	2.1
Springer Nature	1604	1.9
IET/IEE	1098	1.3
Internet Soc/IETF-Internet Eng Task Force	870	1.0
489 others with less than 1% each	17329	17.7

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(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)***

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>International Business Machines Corp</i>		
IEEE	68773	28.7
ACM-Assoc Comput Mach	37584	15.7
IP.Com	14125	5.9
RELX Group (Elsevier)	11682	4.9
Joint IEEE and ACM	11804	4.9
Internet Soc/IETF-Internet Eng Task Force	11558	4.8
Springer Nature	6902	2.9
American Institute of Physics	5785	2.4
National Institute of Standards and Technology (NIST)	5330	2.2
ACS-Am Chem Soc	4803	2.0
IBM Corp.	4463	1.9
The USENIX Association	4379	1.8
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	3396	1.4
Very Large Data Base Endowment Inc. (VLDB Endowment)	2536	1.1
SPIE-Int Soc Opt Engineering	2479	1.0
960 others with less than 1% each	44022	14.6

Johnson & Johnson

RELX Group (Elsevier)	64393	23.8
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	28653	10.6
Springer Nature	27067	10.0
ACS-Am Chem Soc	13950	5.1
Wolters Kluwer	10611	3.9
IEEE	6302	2.3
Natl Acad Sciences	6340	2.3
Oxford University Press	4134	1.5
American SocIETy for Microbiology	3960	1.5
AAAS-Am Assoc Advancement Sci	3675	1.4
Cell Press	3752	1.4
American Society for Pharmacology and Experimental Therapeutics	3567	1.3
Mary Ann Liebert Inc.	2965	1.1
814 others with less than 1% each	91678	29.3

***Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)***

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>Kia Motors Corp.</i>		
IEEE	110	28.1
RELX Group (Elsevier)	101	25.8
ACS-Am Chem Soc	37	9.5
SAE-Society of Automobile Engineers	27	6.9
3GPP General Partnership Project Standards Body	26	6.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	16	4.1
American Institute of Physics	9	2.3
Springer Nature	9	2.3
Royal Society of Chemistry	7	1.8
IET/IEE	6	1.5
ACM-Assoc Comput Mach	4	1.0
Electrochemical Society, Inc.	4	1.0
26 others with less than 1% each	35	9.8
<i>Koninklijke Philips N.V.</i>		
IEEE	8412	21.9
RELX Group (Elsevier)	4740	12.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	3563	9.3
Springer Nature	2495	6.5
Wolters Kluwer	2029	5.3
SPIE-Int Soc Opt Engineering	1762	4.6
Optical Society of America	1367	3.6
American Institute of Physics	1091	2.8
ACM-Assoc Comput Mach	673	1.8
Society of Magnetic Resonance in Medicine (SMRM)	697	1.8
Oxford University Press	524	1.4
IOP Publishing	431	1.1
3GPP General Partnership Project Standards Body	386	1.0
590 others with less than 1% each	10161	22.8
<i>LG Chem Ltd.</i>		
RELX Group (Elsevier)	1822	27.2
ACS-Am Chem Soc	1513	22.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	887	13.2
Royal Society of Chemistry	484	7.2
Springer Nature	317	4.7
American Institute of Physics	270	4.0
Electrochemical Society, Inc.	206	3.1
American SociETy for Microbiology	93	1.4
203 others with less than 1% each	1116	14.1

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>LG Electronics Inc.</i>		
3GPP General Partnership Project Standards Body	34710	60.4
IEEE	10118	17.6
International Telecommunication Union	2013	3.5
ISO/IEC/JTC/ANSI	1646	2.9
European Telecom Standards Institute (ETSI)	1384	2.4
ATSC Std	1311	2.3
Audio Eng Soc	835	1.5
186 others with less than 1% each	5469	8.6
<i>Medtronic Inc</i>		
RELX Group (Elsevier)	34455	17.6
Wolters Kluwer	24452	12.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	17498	9.0
Springer Nature	15352	7.9
IEEE	12718	6.5
American Physiological Society	5563	2.8
Oxford University Press	5050	2.6
American Association of Neurological Surgeons	4161	2.1
Radiological Society of North America	3505	1.8
ACS-Am Chem Soc	3583	1.8
International Federation of Gynecology and Obstetrics (FIGO)	2825	1.4
Mosby Inc.	2345	1.2
SPIE-Int Soc Opt Engineering	2056	1.1
S. Karger AG	2070	1.1
American Heart Association	1919	1.0
609 others with less than 1% each	57825	27.0
<i>Meta Platforms Inc.(formerly Facebook Inc)</i>		
IEEE	2946	25.3
ACM-Assoc Comput Mach	2751	23.7
RELX Group (Elsevier)	672	5.8
Springer Nature	340	2.9
Optical Society of America	277	2.4
Dow Jones & Co.	271	2.3
Joint IEEE and ACM	211	1.8
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	196	1.7
Internet Soc/IETF-Internet Eng Task Force	190	1.6
SPIE-Int Soc Opt Engineering	186	1.6
American Institute of Physics	166	1.4
Condé Nast	148	1.3
ACL - Association for Computational Linguistics	144	1.2
CBS Interactive	137	1.2
Ziff-Davis	130	1.1
C M P Media	114	1.0
188 others with less than 1% each	2751	21.8

***Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)***

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>Micron Technology Inc.</i>		
IEEE	44717	32.5
RELX Group (Elsevier)	23003	16.7
American Institute of Physics	15645	11.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	5754	4.2
IEEE/JPN Soc App Phys	5355	3.9
ACS-Am Chem Soc	4394	3.2
Electrochemical Society, Inc.	3457	2.5
Institute of Pure and Applied Physics	3132	2.3
Springer Nature	3143	2.3
American Physical Society	3096	2.2
MRS-Materials Research Soc	2100	1.5
SPIE-Int Soc Opt Engineering	2053	1.5
Informa/CRC Press/Taylor & Francis	1488	1.1
IOP Publishing	1328	1.0
278 others with less than 1% each	19027	13.3
<i>Microsoft Corporation</i>		
IEEE	72685	31.6
ACM-Assoc Comput Mach	62254	27.1
Joint IEEE and ACM	7387	3.2
RELX Group (Elsevier)	7413	3.2
The USENIX Association	5724	2.5
Springer Nature	5463	2.4
International Telecommunication Union	4336	1.9
Internet Soc/IETF-Internet Eng Task Force	3655	1.6
SPIE-Int Soc Opt Engineering	3020	1.3
Very Large Data Base Endowment Inc. (VLDB Endowment)	2661	1.2
Microsoft	2598	1.1
676 others with less than 1% each	52574	19.0
<i>Mitsubishi Electric Corp</i>		
IEEE	5498	41.7
3GPP General Partnership Project Standards Body	1917	14.5
ACM-Assoc Comput Mach	875	6.6
IEICE-Inst Elec Info Comm Eng	483	3.7
RELX Group (Elsevier)	424	3.2
International Telecommunication Union	355	2.7
IET/IEE	329	2.5
International Association for Cryptologic Research (IACR)	271	2.1
Springer Nature	245	1.9
American Institute of Physics	211	1.6
SPIE-Int Soc Opt Engineering	173	1.3
Optical Society of America	150	1.1
250 others with less than 1% each	2264	14.8

Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>NEC Corp</i>		
3GPP General Partnership Project Standards Body	8271	31.1
IEEE	7365	27.7
ACM-Assoc Comput Mach	1402	5.3
IEICE-Inst Elec Info Comm Eng	890	3.3
RELX Group (Elsevier)	746	2.8
Springer Nature	544	2.0
Optical Society of America	494	1.9
American Institute of Physics	502	1.9
Joint IEEE and ACM	488	1.8
Internet Soc/IETF-Internet Eng Task Force	353	1.3
IET/IEE	267	1.0
377 others with less than 1% each	5295	16.5
<i>Panasonic Corporation</i>		
IEEE	10671	30.3
3GPP General Partnership Project Standards Body	6563	18.7
RELX Group (Elsevier)	1974	5.6
International Telecommunication Union	1985	5.6
IEICE-Inst Elec Info Comm Eng	1718	4.9
American Institute of Physics	1129	3.2
Institute of Pure and Applied Physics	839	2.4
Internet Soc/IETF-Internet Eng Task Force	663	1.9
ACS-Am Chem Soc	486	1.4
ACM-Assoc Comput Mach	495	1.4
Springer Nature	465	1.3
Electrochemical Society, Inc.	454	1.3
SPIE-Int Soc Opt Engineering	435	1.2
ISO/IEC/JTC/ANSI	434	1.2
European Telecom Standards Institute (ETSI)	400	1.1
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	395	1.1
408 others with less than 1% each	6073	14.3
<i>Qualcomm Inc</i>		
IEEE	43229	35.3
3GPP General Partnership Project Standards Body	27911	22.8
International Telecommunication Union	15083	12.3
ISO/IEC/JTC/ANSI	3577	2.9
Internet Soc/IETF-Internet Eng Task Force	2513	2.1
ACM-Assoc Comput Mach	2276	1.9
RELX Group (Elsevier)	2156	1.8
SID-Society for Information Display	1957	1.6
ISO/IEC/JTC	2022	1.6
SPIE-Int Soc Opt Engineering	1544	1.3
Springer Nature	1325	1.1
European Telecom Standards Institute (ETSI)	1233	1.0
412 others with less than 1% each	17726	11.6

Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Raytheon Co.		
IEEE	7412	21.2
NASA-National Aeronautics and Space Admin	3846	11.0
RELX Group (Elsevier)	2271	6.5
IHS Markit	2192	6.3
ASME-Am Soc Mech Eng	1916	5.5
AIAA-Am Inst Aero Astro	1173	3.4
SPIE-Int Soc Opt Engineering	1130	3.2
Optical Society of America	1082	3.1
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1054	3.0
SAE-Society of Automobile Engineers	937	2.7
Springer Nature	900	2.6
ACS-Am Chem Soc	731	2.1
American Institute of Physics	686	2.0
ACM-Assoc Comput Mach	518	1.5
Cambridge University Press	490	1.4
Federal Aviation Administration	446	1.3
McGraw Hill	450	1.3
American Physical Society	405	1.2
American Society of Mechanical Engineers	394	1.1
IET/IEE	375	1.1
SAGE Publications Ltd	358	1.0
418 others with less than 1% each	6231	14.7

Samsung Electronics Co Ltd

3GPP General Partnership Project Standards Body	21675	26.4
IEEE	19349	23.6
RELX Group (Elsevier)	4384	5.3
ACS-Am Chem Soc	4310	5.3
American Institute of Physics	3301	4.0
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2712	3.3
International Telecommunication Union	2455	3.0
Springer Nature	2271	2.8
ACM-Assoc Comput Mach	2210	2.7
SID-Society for Information Display	1556	1.9
SPIE-Int Soc Opt Engineering	1166	1.4
Royal Society of Chemistry	849	1.0
624 others with less than 1% each	15789	15.2

**Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)**

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
Saudi Arabian Oil Company (Saudi Aramco)		
RELX Group (Elsevier)	6443	31.9
ACS-Am Chem Soc	2918	14.5
Society of Petroleum Engineers	2182	10.8
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1619	8.0
Springer Nature	648	3.2
Society of Exploration Geophysicists	650	3.2
Royal Society of Chemistry	590	2.9
IEEE	473	2.3
AMER SOC TESTING MATERIALS	348	1.7
Wolters Kluwer	270	1.3
308 others with less than 1% each	4032	16.3

Seiko Epson Corporation

IEEE	2656	32.7
RELX Group (Elsevier)	648	8.0
American Institute of Physics	596	7.3
ACM-Assoc Comput Mach	532	6.6
Joint IEEE and ACM	525	6.5
SID-Society for Information Display	357	4.4
ACS-Am Chem Soc	287	3.5
Springer Nature	227	2.8
IEEE/JPN Soc App Phys	176	2.2
Institute of Pure and Applied Physics	169	2.1
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	165	2.0
SPIE-Int Soc Opt Engineering	119	1.5
IBM Corp.	114	1.4
American Physical Society	99	1.2
Optical Society of America	86	1.1
IEICE-Inst Elec Info Comm Eng	79	1.0
199 others with less than 1% each	1275	13.0

Siemens Aktiengesellschaft

IEEE	13546	31.9
RELX Group (Elsevier)	5168	12.2
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	4906	11.6
SPIE-Int Soc Opt Engineering	1951	4.6
Springer Nature	1478	3.5
Joint IEEE and ACM	1157	2.7
American Institute of Physics	1027	2.4
ACM-Assoc Comput Mach	889	2.1
Society of Magnetic Resonance in Medicine (SMRM)	661	1.6
Radiological Society of North America	621	1.5
Wolters Kluwer	580	1.4
IOP Publishing	458	1.1
ACS-Am Chem Soc	414	1.0
643 others with less than 1% each	9563	17.7

***Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)***

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
SK Hynix Inc		
IEEE	1417	54.4
American Institute of Physics	135	5.2
Technical Association of Photopolymers	120	4.6
Joint IEEE and ACM	111	4.3
RELX Group (Elsevier)	109	4.2
IEEE/JPN Soc App Phys	107	4.1
ACM-Assoc Comput Mach	91	3.5
SPIE-Int Soc Opt Engineering	62	2.4
ACS-Am Chem Soc	55	2.1
Springer Nature	41	1.6
The USENIX Association	30	1.2
JEDEC Semiconductor Standards Organization	32	1.2
Electrochemical Society, Inc.	29	1.1
Institute of Pure and Applied Physics	25	1.0
68 others with less than 1% each	239	8.2

Sony Group Corp

IEEE	13653	36.1
3GPP General Partnership Project Standards Body	4251	11.2
ACM-Assoc Comput Mach	2749	7.3
International Telecommunication Union	2580	6.8
RELX Group (Elsevier)	1651	4.4
SPIE-Int Soc Opt Engineering	820	2.2
American Institute of Physics	613	1.6
European Telecom Standards Institute (ETSI)	624	1.6
Springer Nature	615	1.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	571	1.5
Internet Soc/IETF-Internet Eng Task Force	526	1.4
ACS-Am Chem Soc	481	1.3
IEICE-Inst Elec Info Comm Eng	461	1.2
Joint IEEE and ACM	468	1.2
455 others with less than 1% each	7801	17.6

***Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)***

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>Taiwan Semiconductor Manufacturing Co.</i>		
IEEE	10468	34.4
American Institute of Physics	7866	25.9
RELX Group (Elsevier)	3167	10.4
Electrochemical Society, Inc.	1189	3.9
Institute of Pure and Applied Physics	997	3.3
IEEE/JPN Soc App Phys	888	2.9
SPIE-Int Soc Opt Engineering	805	2.6
Springer Nature	788	2.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	664	2.2
ACS-Am Chem Soc	363	1.2
IET/IEE	302	1.0
MRS-Materials Research Soc	302	1.0
176 others with less than 1% each	2621	7.6

Texas Instruments Inc

IEEE	11060	60.2
International Telecommunication Union	1363	7.4
RELX Group (Elsevier)	688	3.7
3GPP General Partnership Project Standards Body	659	3.6
American Institute of Physics	610	3.3
Joint IEEE and ACM	337	1.8
SPIE-Int Soc Opt Engineering	314	1.7
IET/IEE	286	1.6
IEEE/JPN Soc App Phys	269	1.5
ACM-Assoc Comput Mach	208	1.1
Springer Nature	198	1.1
SID-Society for Information Display	192	1.0
236 others with less than 1% each	2183	9.3

***Appendix A - Publishers Receiving Most References from Top 50 Companies
(Top 50 Companies in terms of 2020 Patent Activity; References from 2002-2021 Patents)***

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<i>Toshiba Corp</i>		
IEEE	9282	40.0
American Institute of Physics	1726	7.4
RELX Group (Elsevier)	1503	6.5
IEEE/JPN Soc App Phys	808	3.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	701	3.0
Springer Nature	596	2.6
International Telecommunication Union	593	2.6
American Physical Society	564	2.4
IEICE-Inst Elec Info Comm Eng	549	2.4
SPIE-Int Soc Opt Engineering	491	2.1
ACM-Assoc Comput Mach	491	2.1
Institute of Pure and Applied Physics	395	1.7
Internet Soc/IETF-Internet Eng Task Force	376	1.6
ACS-Am Chem Soc	377	1.6
AACS-Advanced Access Content System	299	1.3
Japan Society of Applied Physics	226	1.0
Joint IEEE and ACM	226	1.0
389 others with less than 1% each	3996	14.3

Toyota Motor Corp

IEEE	2446	20.6
RELX Group (Elsevier)	2224	18.8
Springer Nature	737	6.2
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	721	6.1
ACS-Am Chem Soc	674	5.7
American Society of Plant Biologists	380	3.2
American Institute of Physics	351	3.0
ACM-Assoc Comput Mach	270	2.3
AAAS-Am Assoc Advancement Sci	267	2.3
SAE-Society of Automobile Engineers	246	2.1
Optical Society of America	226	1.9
Natl Acad Sciences	208	1.8
Electrochemical Society, Inc.	214	1.8
Royal Society of Chemistry	181	1.5
Informa/CRC Press/Taylor & Francis	120	1.0
Oxford Univ Press	121	1.0
National Institutes of Health - NIH	116	1.0
301 others with less than 1% each	2350	16.5

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>AI/Artificial Intelligence</i>										
1	Microsoft Corporation	3963	11437	34.7	IEEE	3963	34.7	ACM-Assoc Comput Mach	2553	22.3
2	International Business Machi	3935	13653	28.8	IEEE	3935	28.8	ACM-Assoc Comput Mach	1576	11.5
3	Alphabet Inc.	3887	10401	37.4	IEEE	3887	37.4	Neural Information Processing Systems Foundation	934	9.0
4	Adobe Inc. (former Adobe Sy	1424	3088	46.1	IEEE	1424	46.1	ACM-Assoc Comput Mach	679	22.0
5	Apple Inc	1418	3950	35.9	IEEE	1418	35.9	ACM-Assoc Comput Mach	826	20.9
6	Brain Corporation	1061	3160	33.6	IEEE	1061	33.6	MIT Press	424	13.4
7	HRL Laboratories LLC	910	2310	39.4	IEEE	910	39.4	RELX Group (Elsevier)	214	9.3
8	Magic Leap Inc	820	1165	70.4	IEEE	820	70.4	Neural Information Processing Systems Foundation	126	10.8
9	Samsung Electronics Co Ltd	812	1500	54.1	IEEE	812	54.1	ACM-Assoc Comput Mach	85	5.7
10	NUMENTA INC	652	2722	24.0	Numenta Inc.	1008	37.0	IEEE	652	24.0
11	Intel Corporation	601	1398	43.0	IEEE	601	43.0	ACM-Assoc Comput Mach	138	9.9
12	Amazon.com Inc.	599	1529	39.2	IEEE	599	39.2	ACM-Assoc Comput Mach	239	15.6
13	Qualcomm Inc	535	1587	33.7	IEEE	535	33.7	Springer Nature	159	10.0
14	Siemens Aktiengesellschaft	525	1608	32.6	IEEE	525	32.6	RELX Group (Elsevier)	221	13.7
15	The Arizona Board of Regent	481	906	53.1	IEEE	481	53.1	ACM-Assoc Comput Mach	69	7.6
16	NEWVALUEXCHANGE LT	478	1279	37.4	IEEE	478	37.4	ACM-Assoc Comput Mach	297	23.2
17	General Electric Company	455	780	58.3	IEEE	455	58.3	RELX Group (Elsevier)	61	7.8
18	STRONG FORCE IOT PORT	442	567	78.0	IEEE	442	78.0	RELX Group (Elsevier)	52	9.2
19	Cortica Ltd	417	619	67.4	IEEE	417	67.4	ACM-Assoc Comput Mach	71	11.5
20	NVIDIA Corp.	412	726	56.7	IEEE	412	56.7	ACM-Assoc Comput Mach	70	9.6
21	Meta Platforms Inc.(formerly	399	1172	34.0	IEEE	399	34.0	ACM-Assoc Comput Mach	284	24.2
22	Cisco Systems Inc.	394	996	39.6	IEEE	394	39.6	ACM-Assoc Comput Mach	126	12.7
23	SalesforceCom Inc	392	1559	25.1	IEEE	392	25.1	ACL - Association for Computational Linguistics	386	24.8
24	Baidu Inc	383	854	44.8	IEEE	383	44.8	International Machine Learning Society (IMLS)	76	8.9
25	Honda Motor Co. Ltd.(Honda	383	604	63.4	IEEE	383	63.4	RELX Group (Elsevier)	31	5.1
26	University of Alabama	374	484	77.3	IEEE	374	77.3	RELX Group (Elsevier)	24	5.0
27	NEC Corp	355	854	41.6	IEEE	355	41.6	ACM-Assoc Comput Mach	92	10.8
28	Xerox Corp	343	1079	31.8	IEEE	343	31.8	ACM-Assoc Comput Mach	125	11.6
29	Columbia University	322	1018	31.6	IEEE	322	31.6	ACM-Assoc Comput Mach	136	13.4
30	SAS Institute	321	1227	26.2	IEEE	321	26.2	RELX Group (Elsevier)	173	14.1
31	Xperi Holding Corporation (F	314	545	57.6	IEEE	314	57.6	Joint IEEE and ACM	39	7.2
32	Toyota Motor Corp	306	477	64.2	IEEE	306	64.2	Neural Information Processing Systems Foundation	26	5.5
33	IP RESERVOIR LLC	270	512	52.7	IEEE	270	52.7	ACM-Assoc Comput Mach	75	14.6
34	Oracle Corporation	257	1419	18.1	IEEE	257	18.1	ACL - Association for Computational Linguistics	220	15.5
35	Twitter Inc	252	352	71.6	IEEE	252	71.6	International Machine Learning Society (IMLS)	22	6.3
36	Fujitsu Limited	246	664	37.0	IEEE	246	37.0	Joint IEEE and ACM	88	13.3
37	CARTICA AI LTD	222	339	65.5	IEEE	222	65.5	ACM-Assoc Comput Mach	34	10.0
38	Battelle Memorial Institute	212	362	58.6	IEEE	212	58.6	RELX Group (Elsevier)	36	9.9
39	Massachusetts Institute of Te	210	1112	18.9	IEEE	210	18.9	Springer Nature	182	16.4

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Sony Group Corp	209	478	43.7	IEEE	209	43.7	ACM-Assoc Comput Mach	40	8.4
41	University of Tennessee Rese	200	473	42.3	IEEE	200	42.3	RELX Group (Elsevier)	61	12.9
42	eBay Inc	196	330	59.4	IEEE	196	59.4	ACM-Assoc Comput Mach	34	10.3
43	University of California	193	1756	11.0	Oxford University Press	285	16.2	Springer Nature	224	12.8
44	TuSimple	185	237	78.1	IEEE	185	78.1	ACM-Assoc Comput Mach	13	5.5
45	Bosch (Robert) GmbH	184	362	50.8	IEEE	184	50.8	Neural Information Processing Systems Foundation	19	5.2
46	NEURALA INC	184	369	49.9	IEEE	184	49.9	MIT Press	30	8.1
47	Raytheon Co.	175	381	45.9	IEEE	175	45.9	RELX Group (Elsevier)	27	7.1
48	FireEye Inc	173	483	35.8	IEEE	173	35.8	ACM-Assoc Comput Mach	85	17.6
49	Omni Ai Inc. Inc (formerly B	172	211	81.5	IEEE	172	81.5	International Association for Pattern Recognition (IAPR)	22	10.4
50	Huawei Technologies Compa	166	390	42.6	IEEE	166	42.6	ACM-Assoc Comput Mach	50	12.8
51	Nokia Corporation	162	343	47.2	IEEE	162	47.2	ACM-Assoc Comput Mach	41	12.0
52	AT&T Inc	160	452	35.4	IEEE	160	35.4	ACM-Assoc Comput Mach	109	24.1
53	SRI International	159	367	43.3	IEEE	159	43.3	ACM-Assoc Comput Mach	25	6.8
54	Accenture Ltd.	158	588	26.9	IEEE	158	26.9	ACM-Assoc Comput Mach	95	16.2
55	Micron Technology Inc.	158	235	67.2	IEEE	158	67.2	ACM-Assoc Comput Mach	18	7.7
56	NEW VALUEEXCHANGE L	155	406	38.2	IEEE	155	38.2	ACM-Assoc Comput Mach	87	21.4
57	Ohio State University	152	185	82.2	IEEE	152	82.2	RELX Group (Elsevier)	10	5.4
58	Boeing Co. (The)	150	455	33.0	IEEE	150	33.0	RELX Group (Elsevier)	68	14.9
59	Naver Corp.	150	167	89.8	IEEE	150	89.8	ACM-Assoc Comput Mach	9	5.4
60	Walt Disney Co.	148	462	32.0	IEEE	148	32.0	ACM-Assoc Comput Mach	122	26.4
61	Canon Inc	145	297	48.8	IEEE	145	48.8	RELX Group (Elsevier)	19	6.4
62	CapitalOne	143	451	31.7	IEEE	143	31.7	RELX Group (Elsevier)	46	10.2
63	Cornell University	142	1350	10.5	RELX Group (Elsevier)	201	14.9	Springer Nature	155	11.5
64	United States Navy	140	305	45.9	IEEE	140	45.9	RELX Group (Elsevier)	50	16.4
65	INCEPTION INSTITUTE OF	136	185	73.5	IEEE	136	73.5	ACM-Assoc Comput Mach	17	9.2
66	Spotify AB	130	213	61.0	IEEE	130	61.0	International Society for Music Information Retrieval Conferen	37	17.4
67	ICOSYSTEM CORP	127	174	73.0	IEEE	127	73.0	RELX Group (Elsevier)	9	5.2
68	Toshiba Corp	125	228	54.8	IEEE	125	54.8	RELX Group (Elsevier)	17	7.5
69	Aerospace Corp.	123	383	32.1	RELX Group (Elsevier)	123	32.1	IEEE	123	32.1
70	VIA ALLIANCE SEMICON	123	463	26.6	IEEE	123	26.6	Joint IEEE and ACM	91	19.7
71	GYRFALCON TECHNOLO	122	205	59.5	IEEE	122	59.5	RELX Group (Elsevier)	45	22.0
72	Sap SE	119	398	29.9	IEEE	119	29.9	ACM-Assoc Comput Mach	63	15.8
73	Motorola Solutions Inc.	118	144	81.9	IEEE	118	81.9	International Association for Pattern Recognition (IAPR)	7	4.9
74	University of South Florida	117	217	53.9	IEEE	117	53.9	RELX Group (Elsevier)	25	11.5
75	Mitsubishi Electric Corp	116	218	53.2	IEEE	116	53.2	ACM-Assoc Comput Mach	9	4.1
76	CEREBRAS SYSTEMS INC	113	205	55.1	IEEE	113	55.1	Joint IEEE and ACM	34	16.6
77	CARDIOLOGS TECHNOLO	112	254	44.1	IEEE	112	44.1	Neural Information Processing Systems Foundation	27	10.6
78	Zebra Technologies Corp.	111	151	73.5	IEEE	111	73.5	RFID Journal/YGS Group	26	17.2
79	University of Illinois	110	396	27.8	IEEE	110	27.8	Springer Nature	45	11.4
80	PRIMAL FUSION INC	108	241	44.8	IEEE	108	44.8	ACM-Assoc Comput Mach	39	16.2

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	23ANDME INC	106	1108	9.6	Cell Press	250	22.6	Springer Nature	159	14.4
82	Marvell Technology Group Lt	106	184	57.6	IEEE	106	57.6	ACM-Assoc Comput Mach	43	23.4
83	Snap Inc	102	225	45.3	IEEE	102	45.3	ACM-Assoc Comput Mach	43	19.1
84	COGNIZANT TECHNOLOG	97	404	24.0	IEEE	97	24.0	ACM-Assoc Comput Mach	60	14.9
85	Purdue University	97	178	54.5	IEEE	97	54.5	ACM-Assoc Comput Mach	34	19.1
86	Lockheed Martin Corp.	95	156	60.9	IEEE	95	60.9	RELX Group (Elsevier)	15	9.6
87	Blackberry Ltd.	93	233	39.9	IEEE	93	39.9	ACM-Assoc Comput Mach	31	13.3
88	DIVEPLANE CORP	93	488	19.1	IEEE	93	19.1	Springer Nature	68	13.9
89	Cleveland Clinic (and Founda	92	471	19.5	IEEE	92	19.5	RELX Group (Elsevier)	85	18.0
90	INDIVIDUAL PATENTER	92	316	29.1	IEEE	92	29.1	ACM-Assoc Comput Mach	41	13.0
91	Cambricon Technologies Co	91	371	24.5	ACM-Assoc Comput Mach	143	38.5	Joint IEEE and ACM	135	36.4
92	PINDROP SECURITY INC	90	146	61.6	IEEE	90	61.6	International Speech Communication Association (ISCA)	25	17.1
93	ASAPP INC	89	404	22.0	ACL - Association for Computational Linguist	92	22.8	IEEE	89	22.0
94	Nielsen Holdings Plc	88	400	22.0	IEEE	88	22.0	RELX Group (Elsevier)	44	11.0
95	Commissariat A L'Energie At	87	139	62.6	IEEE	87	62.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	14	10.1
96	Honeywell International Inc.	87	257	33.9	IEEE	87	33.9	RELX Group (Elsevier)	59	23.0
97	Boston Scientific Corp.	86	515	16.7	RELX Group (Elsevier)	109	21.2	IEEE	86	16.7
98	LIGHTMATTER INC	86	292	29.5	IEEE	86	29.5	Springer Nature	65	22.3
99	APEX ARTIFICIAL INTELL	84	292	28.8	IEEE	84	28.8	RELX Group (Elsevier)	44	15.1
100	Ford Motor Co.	83	163	50.9	IEEE	83	50.9	ACM-Assoc Comput Mach	15	9.2

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Autonomous Vehicles</i>										
1	Irobot Corp	1712	3096	55.3	IEEE	1712	55.3	SPIE-Int Soc Opt Engineering	408	13.2
2	Amazon.com Inc.	700	1056	66.3	IEEE	700	66.3	SAGE Publications Ltd	80	7.6
3	TuSimple	665	870	76.4	IEEE	665	76.4	US National Research Council	53	6.1
4	State Farm Mutual Automobi	386	1269	30.4	IEEE	386	30.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	101	8.0
5	Alphabet Inc.	313	581	53.9	IEEE	313	53.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	29	5.0
6	Nio Co. Ltd	276	489	56.4	IEEE	276	56.4	CBS Interactive	36	7.4
7	Walmart Stores Inc	266	737	36.1	IEEE	266	36.1	CBS Interactive	82	11.1
8	CARTICA AI LTD	218	331	65.9	IEEE	218	65.9	ACM-Assoc Comput Mach	29	8.8
9	Aptiv Plc (former Delphi Aut	211	399	52.9	IEEE	211	52.9	RELX Group (Elsevier)	32	8.0
10	UATC LLC	164	245	66.9	IEEE	164	66.9	IEEE/RSJ	23	9.4
11	Toyota Motor Corp	161	266	60.5	IEEE	161	60.5	Springer Nature	16	6.0
12	Brain Corporation	140	309	45.3	IEEE	140	45.3	Frontiers Media S.A.	26	8.4
13	MOTIONAL AD LLC	138	285	48.4	IEEE	138	48.4	RELX Group (Elsevier)	21	7.4
14	Siemens Aktiengesellschaft	135	203	66.5	IEEE	135	66.5	Springer Nature	17	8.4
15	NURO INC	121	178	68.0	IEEE	121	68.0	Neural Information Processing Systems Foundation	12	6.7
16	Intel Corporation	119	386	30.8	IEEE	119	30.8	MIT/MIT Press	45	11.7
17	International Business Machi	109	520	21.0	IEEE	109	21.0	IP.Com	96	18.5
18	Uber Technologies Inc	108	177	61.0	IEEE	108	61.0	Joint IEEE and ACM	9	5.1
19	Ford Motor Co.	105	196	53.6	IEEE	105	53.6	SAE-Society of Automobile Engineers	20	10.2
20	Boeing Co. (The)	102	220	46.4	IEEE	102	46.4	American Helicopter Society	14	6.4
21	HRL Laboratories LLC	102	162	63.0	IEEE	102	63.0	IEEE/RSJ	15	9.3
22	FedEx Corp	96	289	33.2	IEEE	96	33.2	RELX Group (Elsevier)	49	17.0
23	University of Pennsylvania	93	172	54.1	IEEE	93	54.1	IEEE/RSJ	14	8.1
24	Nissan Motor Co. Ltd.	92	120	76.7	IEEE	92	76.7	Mcgraw Hill	7	5.8
25	NVIDIA Corp.	90	167	53.9	IEEE	90	53.9	RELX Group (Elsevier)	14	8.4
26	Honda Motor Co. Ltd.(Honda	89	178	50.0	IEEE	89	50.0	RELX Group (Elsevier)	17	9.6
27	APEX ARTIFICIAL INTELL	82	272	30.1	IEEE	82	30.1	Springer Nature	40	14.7
28	IFLIGHT Innovation Technol	82	149	55.0	IEEE	82	55.0	SAGE Publications Ltd	14	9.4
29	Baidu Inc	81	115	70.4	IEEE	81	70.4	SAE-Society of Automobile Engineers	6	5.2
30	PELTON TECHNOLOGY I	66	131	50.4	IEEE	66	50.4	American Automatic Control Council (AACC)	18	13.7
31	Zebra Technologies Corp.	65	127	51.2	IEEE	65	51.2	ACM-Assoc Comput Mach	12	9.4
32	SPHERO INC	64	67	95.5	IEEE	64	95.5	American Automatic Control Council (AACC)	3	4.5
33	INTOUCH HEALTH INC	63	166	38.0	IEEE	63	38.0	Springer Nature	12	7.2
34	California Institute of Techno	59	148	39.9	IEEE	59	39.9	IOP Publishing	12	8.1
35	Renault SA	59	70	84.3	IEEE	59	84.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	4	5.7
36	TRIFO INC	53	68	77.9	IEEE	53	77.9	SAGE Publications Ltd	15	22.1
37	DIVEPLANE CORP	50	232	21.6	IEEE	50	21.6	Springer Nature	32	13.8
38	Allstate Corp	45	100	45.0	IEEE	45	45.0	Dow Jones & Co.	12	12.0
39	General Motors Corp	43	65	66.2	IEEE	43	66.2	RELX Group (Elsevier)	4	6.2

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Garrett Motion (formerly Gar	41	145	28.3	SAE-Society of Automobile Engineers	48	33.1	IEEE	41	28.3
41	Digimarc Corp.	37	91	40.7	IEEE	37	40.7	ACM-Assoc Comput Mach	14	15.4
42	MENTOR GRAPHICS (DEU	34	49	69.4	IEEE	34	69.4	Springer Nature	4	8.2
43	STRADVISION INC	34	44	77.3	IEEE	34	77.3	RELX Group (Elsevier)	2	4.5
44	Qualcomm Inc	33	52	63.5	IEEE	33	63.5	SAGE Publications Ltd	6	11.5
45	Zhejiang Geely Holding Grou	33	43	76.7	IEEE	33	76.7	Springer Nature	3	7.0
46	Toshiba Corp	31	51	60.8	IEEE	31	60.8	European Conference on Computer Vision-Google/Microsoft	7	13.7
47	University of Massachusetts	30	38	78.9	IEEE	30	78.9	Mcgraw Hill	7	18.4
48	Bosch (Robert) GmbH	29	40	72.5	IEEE	29	72.5	IEEE/RSJ	2	5.0
49	Deere & Co.	29	59	49.2	IEEE	29	49.2	AMER SOC AGRICULTURAL & BIOLOGICAL ENGINEER	5	8.5
50	NEC Corp	28	45	62.2	IEEE	28	62.2	European Conference on Computer Vision-Google/Microsoft	6	13.3
51	AUTONOMOUS SOLUTIO	27	77	35.1	IEEE	27	35.1	American Automatic Control Council (AACC)	15	19.5
52	Lockheed Martin Corp.	27	548	4.9	American Physical Society	99	18.1	Springer Nature	96	17.5
53	University of Michigan	26	40	65.0	IEEE	26	65.0	American Automatic Control Council (AACC)	2	5.0
54	AURORA OPERATIONS IN	23	31	74.2	IEEE	23	74.2	American Society of Mechanical Engineers	2	6.5
55	Oshkosh Corporation	23	30	76.7	IEEE	23	76.7	SAE-Society of Automobile Engineers	2	6.7
56	EPISYS SCIENCE INC	22	44	50.0	IEEE	22	50.0	JOHNS HOPKINS UNIV, APPLIED PHYSICS LABORATO	6	13.6
57	CARTICA AL LTD	21	30	70.0	IEEE	21	70.0	SPIE-Int Soc Opt Engineering	2	6.7
58	Aviation Industry Corporatio	20	33	60.6	IEEE	20	60.6	SAE-Society of Automobile Engineers	12	36.4
59	Duchossois Group Inc	20	61	32.8	IEEE	20	32.8	International Association for Cryptologic Research (IACR)	10	16.4
60	NONEND INVENTIONS N	20	21	95.2	IEEE	20	95.2	The International Association for Computers and Communicati	1	4.8
61	Fujitsu Limited	19	29	65.5	IEEE	19	65.5	New York Times	2	6.9
62	HANGZHOU ZERO ZERO	19	25	76.0	IEEE	19	76.0	SAGE Publications Ltd	4	16.0
63	BEIJING TUSEN ZHITU TE	18	22	81.8	IEEE	18	81.8	European Conference on Computer Vision-Google/Microsoft	2	9.1
64	CYBERNET SYSTEMS CO	17	31	54.8	IEEE	17	54.8	Defense Advanced Research Projects Agency (DARPA)	4	12.9
65	Mitsubishi Electric Corp	17	26	65.4	IEEE	17	65.4	American Automatic Control Council (AACC)	3	11.5
66	Raytheon Co.	17	41	41.5	IEEE	17	41.5	SPIE-Int Soc Opt Engineering	9	22.0
67	Battelle Memorial Institute	16	24	66.7	IEEE	16	66.7	IEEE/RSJ	6	25.0
68	Panasonic Corporation	16	21	76.2	IEEE	16	76.2	IEEE/RSJ	2	9.5
69	PERCEPTIVE AUTOMATA	16	22	72.7	IEEE	16	72.7	Neural Information Processing Systems Foundation	6	27.3
70	AURORA INNOVATION IN	15	24	62.5	IEEE	15	62.5	Morgan Kaufmann Publishers, Inc.	2	8.3
71	BRIAN CORP	15	35	42.9	IEEE	15	42.9	MIT Press	3	8.6
72	GECKO ROBOTICS INC	15	30	50.0	IEEE	15	50.0	RELX Group (Elsevier)	8	26.7
73	Here Global BV	15	28	53.6	IEEE	15	53.6	RELX Group (Elsevier)	5	17.9
74	King Fahd University of Petr	15	21	71.4	IEEE	15	71.4	American Automatic Control Council (AACC)	2	9.5
75	PATRONESS LLC	14	27	51.9	IEEE	14	51.9	JTC Std	5	18.5
76	PERCEPTIN SHENZHEN L	14	17	82.4	IEEE	14	82.4	SAGE Publications Ltd	2	11.8
77	Walt Disney Co.	14	15	93.3	IEEE	14	93.3	CBS Interactive	1	6.7
78	Wipro Ltd	14	20	70.0	IEEE	14	70.0	RELX Group (Elsevier)	2	10.0
79	AT&T Inc	13	26	50.0	IEEE	13	50.0	RELX Group (Elsevier)	5	19.2
80	The Arizona Board of Regent	13	26	50.0	IEEE	13	50.0	Joint IEEE and ACM	3	11.5

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	AFFECTIVA INC	12	20	60.0	IEEE	12	60.0	RELX Group (Elsevier)	4	20.0
82	Denso Corp	12	24	50.0	IEEE	12	50.0	RELX Group (Elsevier)	5	20.8
83	PERRONE ROBOTICS INC	12	19	63.2	IEEE	12	63.2	IEEE/RSJ	4	21.1
84	Porsche Automobil Holding S	12	16	75.0	IEEE	12	75.0	ASME-Am Soc Mech Eng	1	6.3
85	Samsung Electronics Co Ltd	12	13	92.3	IEEE	12	92.3	ACM-Assoc Comput Mach	1	7.7
86	ZYTEK COMMUNICATIO	12	44	27.3	IEEE	12	27.3	COMPANY OF BIOLOGISTS LTD	6	13.6
87	ARGO AI LLC	11	17	64.7	IEEE	11	64.7	Springer Nature	2	11.8
88	STARSHIP TECHNOLOGIE	11	18	61.1	IEEE	11	61.1	RELX Group (Elsevier)	4	22.2
89	BAE Systems Plc.	10	21	47.6	IEEE	10	47.6	American Meteorological Society	3	14.3
90	Carnegie Mellon University	10	12	83.3	IEEE	10	83.3	American Automatic Control Council (AACC)	1	8.3
91	Florida Atlantic University	10	28	35.7	IEEE	10	35.7	RELX Group (Elsevier)	3	10.7
92	InterDigital Inc	10	19	52.6	IEEE	10	52.6	European Telecom Standards Institute (ETSI)	4	21.1
93	LUMINAR TECHNOLOGIE	10	16	62.5	IEEE	10	62.5	RELX Group (Elsevier)	4	25.0
94	NXP Semiconductors NV	10	12	83.3	IEEE	10	83.3	IET/IEE	1	8.3
95	ROBART GMBH	10	13	76.9	IEEE	10	76.9	Joint IEEE and ACM	3	23.1
96	Aerospace Corp.	9	26	34.6	IEEE	9	34.6	SPIE-Int Soc Opt Engineering	4	15.4
97	Casio Computer	9	10	90.0	IEEE	9	90.0	Springer Nature	1	10.0
98	Charles Stark Draper Laborat	9	12	75.0	IEEE	9	75.0	New York Times	1	8.3
99	CRINKLAW FARM SERVI	9	16	56.3	IEEE	9	56.3	Springer Nature	4	25.0
100	The National Aeronautical an	9	21	42.9	IEEE	9	42.9	RELX Group (Elsevier)	3	14.3

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Blockchain/Distributed Ledger</i>										
1	Advanced New Technologies	280	471	59.4	IEEE	280	59.4	ACM-Assoc Comput Mach	33	7.0
2	International Business Machi	150	430	34.9	IEEE	150	34.9	IP.Com	83	19.3
3	Cisco Systems Inc.	108	173	62.4	IEEE	108	62.4	The USENIX Association	11	6.4
4	Alibaba Group Holding Ltd	102	183	55.7	IEEE	102	55.7	ACM-Assoc Comput Mach	32	17.5
5	IP RESERVOIR LLC	82	152	53.9	IEEE	82	53.9	ACM-Assoc Comput Mach	26	17.1
6	Juniper Networks Inc.	35	38	92.1	IEEE	35	92.1	Defense Advanced Research Projects Agency (DARPA)	1	2.6
7	Bank of America Corp.	34	68	50.0	IEEE	34	50.0	New York Times	20	29.4
8	BT Group PLC	33	83	39.8	IEEE	33	39.8	RELX Group (Elsevier)	19	22.9
9	Microsoft Corporation	33	106	31.1	ACM-Assoc Comput Mach	37	34.9	IEEE	33	31.1
10	Marvell Technology Group Lt	28	29	96.6	IEEE	28	96.6	ACM-Assoc Comput Mach	1	3.4
11	AMERICORP INVESTMEN	26	27	96.3	IEEE	26	96.3	World Wide Web Consortium	1	3.7
12	BLOCKCHAIN ASICS INC	25	25	100.0	IEEE	25	100.0			
13	Dell Technologies Inc	25	79	31.6	ACM-Assoc Comput Mach	35	44.3	IEEE	25	31.6
14	FACTOM INC	24	38	63.2	IEEE	24	63.2	Dow Jones & Co.	10	26.3
15	Accenture Ltd.	23	90	25.6	ACM-Assoc Comput Mach	45	50.0	IEEE	23	25.6
16	nChain Holdings Ltd	23	59	39.0	IEEE	23	39.0	International Financial Cryptography Association	13	22.0
17	COGNITIVE SCALE INC	20	52	38.5	IEEE	20	38.5	Very Large Data Base Endowment Inc. (VLDB Endowment)	8	15.4
18	University of South Florida	20	22	90.9	IEEE	20	90.9	Joint IEEE and ACM	1	4.5
19	ELUVIO INC	18	58	31.0	IEEE	18	31.0	ACM-Assoc Comput Mach	12	20.7
20	NXGEN PARTNERS IP LLC	18	55	32.7	Optical Society of America	20	36.4	IEEE	18	32.7
21	Amazon.com Inc.	17	40	42.5	IEEE	17	42.5	ISO-International Standards Organization	8	20.0
22	eBay Inc	16	18	88.9	IEEE	16	88.9	RELX Group (Elsevier)	1	5.6
23	SYMBIONT IO INC	16	40	40.0	IEEE	16	40.0	ACM-Assoc Comput Mach	10	25.0
24	Intel Corporation	13	27	48.1	IEEE	13	48.1	ACM-Assoc Comput Mach	7	25.9
25	NEC Corp	13	46	28.3	ACM-Assoc Comput Mach	22	47.8	IEEE	13	28.3
26	INVENIAM CAPITAL PAR	12	20	60.0	IEEE	12	60.0	ACM-Assoc Comput Mach	4	20.0
27	MasterCard Inc	12	23	52.2	IEEE	12	52.2	ACM-Assoc Comput Mach	5	21.7
28	Ant Group (ANT Financial S	11	15	73.3	IEEE	11	73.3	RELX Group (Elsevier)	2	13.3
29	MOX-SPEEDCHAIN LLC	11	11	100.0	IEEE	11	100.0			
30	SalesforceCom Inc	10	11	90.9	IEEE	10	90.9	ACM-Assoc Comput Mach	1	9.1
31	Broadcom Ltd	9	11	81.8	IEEE	9	81.8	ACM-Assoc Comput Mach	1	9.1
32	MILESTONE ENTERTAIN	9	28	32.1	IEEE	9	32.1	The USENIX Association	5	17.9
33	Via Technologies Inc.	9	16	56.3	IEEE	9	56.3	Joint IEEE and ACM	2	12.5
34	AT&T Inc	8	13	61.5	IEEE	8	61.5	FORBES INC	2	15.4
35	CapitalOne	8	24	33.3	IEEE	8	33.3	Condé Nast	4	16.7
36	Causam Energy Inc	8	13	61.5	IEEE	8	61.5	RELX Group (Elsevier)	2	15.4
37	Hewlett Packard Enterprises	8	18	44.4	IEEE	8	44.4	ACM-Assoc Comput Mach	3	16.7
38	LG Electronics Inc.	8	9	88.9	IEEE	8	88.9	World Academy of Science Engineering and Technology	1	11.1
39	Micron Technology Inc.	8	12	66.7	IEEE	8	66.7	Joint IEEE and ACM	2	16.7

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	State Farm Mutual Automobi	8	16	50.0	IEEE	8	50.0	Economist Newspaper Ltd.	2	12.5
41	ANTHURIUM SOLUTIONS	7	42	16.7	ACM-Assoc Comput Mach	15	35.7	IEEE	7	16.7
42	Emerson Electric Co.	7	7	100.0	IEEE	7	100.0			
43	FORCEPOINT LLC	7	9	77.8	IEEE	7	77.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2	22.2
44	Nokia Corporation	7	16	43.8	IEEE	7	43.8	Internet Soc/IETF-Internet Eng Task Force	2	12.5
45	Sap SE	7	18	38.9	IEEE	7	38.9	ACM-Assoc Comput Mach	2	11.1
46	TURING TECHNOLOGY IN	7	13	53.8	IEEE	7	53.8	RELX Group (Elsevier)	5	38.5
47	FACETEC INC	6	6	100.0	IEEE	6	100.0			
48	Oracle Corporation	6	23	26.1	ACM-Assoc Comput Mach	7	30.4	IEEE	6	26.1
49	SYNIVERSE TECHNOLOGI	6	13	46.2	IEEE	6	46.2	Network Working Group RFC	2	15.4
50	Workday Inc	6	7	85.7	IEEE	6	85.7	National Institute of Standards and Technology (NIST)	1	14.3
51	Endress+Hauser (Internationa	5	5	100.0	IEEE	5	100.0			
52	Zhejiang Geely Holding Grou	5	7	71.4	IEEE	5	71.4	ACM-Assoc Comput Mach	2	28.6
53	BLOCK ONE	4	4	100.0	IEEE	4	100.0			
54	CLOUDMINDS (SHANGHA	4	7	57.1	IEEE	4	57.1	IEEE/NASA	1	14.3
55	DIGITAL ASSET HOLDING	4	6	66.7	IEEE	4	66.7	First Monday	2	33.3
56	ESHARD	4	17	23.5	International Association for Cryptologic Rese	8	47.1	IEEE	4	23.5
57	EYGS LLP	4	21	19.0	The USENIX Association	4	19.0	IEEE	4	19.0
58	Institute for Information Indu	4	5	80.0	IEEE	4	80.0	Harvard Business School Publishing	1	20.0
59	MASSACHUSETTS MUTU	4	5	80.0	IEEE	4	80.0	International Association for Cryptologic Research (IACR)	1	20.0
60	Northwestern University	4	12	33.3	RELX Group (Elsevier)	4	33.3	IEEE	4	33.3
61	Open Invention Network Llc	4	4	100.0	IEEE	4	100.0			
62	SERVICENOW INC	4	4	100.0	IEEE	4	100.0			
63	SMARTAXIOM INC	4	4	100.0	IEEE	4	100.0			
64	Sony Group Corp	4	4	100.0	IEEE	4	100.0			
65	THE BANK OF NEW YORK	4	5	80.0	IEEE	4	80.0	IEICE-Inst Elec Info Comm Eng	1	20.0
66	THE TORONTO-DOMINIO	4	25	16.0	World Wide Web Consortium	9	36.0	Imagine Publishing	9	36.0
67	VMWare Inc	4	8	50.0	IEEE	4	50.0	IET/IEE	1	12.5
68	21 INC	3	4	75.0	IEEE	3	75.0	ACM-Assoc Comput Mach	1	25.0
69	Boeing Co. (The)	3	5	60.0	IEEE	3	60.0	IP.Com	1	20.0
70	Commonwealth Scientific an	3	4	75.0	IEEE	3	75.0	Nikkei Business Publications, Inc.	1	25.0
71	Dish Network Corp	3	5	60.0	IEEE	3	60.0	European Telecom Standards Institute (ETSI)	2	40.0
72	Ericsson	3	3	100.0	IEEE	3	100.0			
73	ERNST & YOUNG U S LLP	3	15	20.0	IEEE	3	20.0	ISO-International Standards Organization	3	20.0
74	FARMOBILE LLC	3	3	100.0	IEEE	3	100.0			
75	GUANGZHOU UNIVERSIT	3	5	60.0	IEEE	3	60.0	RELX Group (Elsevier)	1	20.0
76	HELIUM SYSTEMS INC	3	5	60.0	IEEE	3	60.0	RELX Group (Elsevier)	2	40.0
77	Huawei Technologies Compa	3	6	50.0	IEEE	3	50.0	RELX Group (Elsevier)	1	16.7
78	McAfee Inc	3	7	42.9	IEEE	3	42.9	ACM-Assoc Comput Mach	2	28.6
79	Meta Platforms Inc.(formerly	3	25	12.0	ACM-Assoc Comput Mach	11	44.0	International Association for Cryptologic Research (IACR)	4	16.0
80	Naver Corp.	3	3	100.0	IEEE	3	100.0			

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	NUID INC	3	34	8.8	Internet Soc/IETF-Internet Eng Task Force	12	35.3	International Association for Cryptologic Research (IACR)	8	23.5
82	Panasonic Corporation	3	7	42.9	Information Processing Society of Japan	3	42.9	IEEE	3	42.9
83	REFINITIV US ORGANIZA	3	3	100.0	IEEE	3	100.0			
84	Samsung Electronics Co Ltd	3	5	60.0	IEEE	3	60.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1	20.0
85	Seagate Technology Plc	3	3	100.0	IEEE	3	100.0			
86	THE FLORIDA INTERNATI	3	3	100.0	IEEE	3	100.0			
87	THE UNIVERSITY OF STA	3	4	75.0	IEEE	3	75.0	Australian comp soc	1	25.0
88	THE VANGUARD GROUP I	3	8	37.5	IEEE	3	37.5	ACM-Assoc Comput Mach	2	25.0
89	THETA LABS INC	3	4	75.0	IEEE	3	75.0	ACM-Assoc Comput Mach	1	25.0
90	Toyota Motor Corp	3	3	100.0	IEEE	3	100.0			
91	United Services Automobile	3	6	50.0	IEEE	3	50.0	ACM-Assoc Comput Mach	2	33.3
92	UT-Battelle LLC	3	3	100.0	IEEE	3	100.0			
93	ACRONIS INTERNATIONALA	2	3	66.7	IEEE	2	66.7	Joint IEEE and ACM	1	33.3
94	ACUANT INC	2	2	100.0	IEEE	2	100.0			
95	Adobe Inc. (former Adobe Sy	2	3	66.7	IEEE	2	66.7	The USENIX Association	1	33.3
96	AMARI AI INC	2	3	66.7	IEEE	2	66.7	RELX Group (Elsevier)	1	33.3
97	ANCHOR LABS INC	2	6	33.3	IEEE	2	33.3	Condé Nast	2	33.3
98	ANONOS INC	2	20	10.0	New York Times	6	30.0	Dow Jones & Co.	3	15.0
99	Atos SE	2	4	50.0	Springer Nature	2	50.0	IEEE	2	50.0
100	BITPAGOS INC	2	4	50.0	Source Media	2	50.0	IEEE	2	50.0

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Broadcasting</i>										
1	Microsoft Corporation	11759	27520	42.7	IEEE	11759	42.7	ACM-Assoc Comput Mach	3309	12.0
2	Xperi Holding Corporation (F	11418	29262	39.0	IEEE	11418	39.0	SPIE-Int Soc Opt Engineering	2723	9.3
3	Personalized Media Commun	7995	49103	16.3	Society of Motion Picture and Television Engi	14875	30.3	IEEE	7995	16.3
4	Alphabet Inc.	5973	17552	34.0	IEEE	5973	34.0	International Telecommunication Union	2817	16.0
5	Qualcomm Inc	5609	30956	18.1	International Telecommunication Union	14416	46.6	IEEE	5609	18.1
6	Magna International Inc.	4554	8429	54.0	IEEE	4554	54.0	SAE-Society of Automobile Engineers	721	8.6
7	Sony Group Corp	3636	10431	34.9	IEEE	3636	34.9	International Telecommunication Union	2493	23.9
8	Apple Inc	3363	9603	35.0	IEEE	3363	35.0	ACM-Assoc Comput Mach	1302	13.6
9	Samsung Electronics Co Ltd	2720	9485	28.7	IEEE	2720	28.7	International Telecommunication Union	2270	23.9
10	AT&T Inc	2594	5942	43.7	IEEE	2594	43.7	ACM-Assoc Comput Mach	674	11.3
11	Technicolor SA	2071	4917	42.1	IEEE	2071	42.1	ISO/IEC/JTC/ANSI	351	7.1
12	Cisco Systems Inc.	2029	5247	38.7	IEEE	2029	38.7	ACM-Assoc Comput Mach	447	8.5
13	Dolby Laboratories Inc	1873	7349	25.5	International Telecommunication Union	1940	26.4	IEEE	1873	25.5
14	LG Electronics Inc.	1862	8718	21.4	IEEE	1862	21.4	International Telecommunication Union	1765	20.2
15	Broadcom Ltd	1777	2824	62.9	IEEE	1777	62.9	ACM-Assoc Comput Mach	172	6.1
16	Massachusetts Institute of Te	1672	3080	54.3	IEEE	1672	54.3	ACM-Assoc Comput Mach	272	8.8
17	Intel Corporation	1655	4272	38.7	IEEE	1655	38.7	3GPP General Partnership Project Standards Body	1024	24.0
18	General Electric Company	1645	5527	29.8	International Telecommunication Union	2126	38.5	IEEE	1645	29.8
19	Panasonic Corporation	1616	5658	28.6	International Telecommunication Union	1695	30.0	IEEE	1616	28.6
20	Sonos Inc	1491	3717	40.1	IEEE	1491	40.1	SPIE-Int Soc Opt Engineering	457	12.3
21	Adobe Inc. (former Adobe Sy	1421	3165	44.9	IEEE	1421	44.9	ACM-Assoc Comput Mach	709	22.4
22	InterDigital Inc	1391	4800	29.0	IEEE	1391	29.0	International Telecommunication Union	1277	26.6
23	Nokia Corporation	1302	3806	34.2	IEEE	1302	34.2	International Telecommunication Union	536	14.1
24	Fraunhofer Gesellschaft	1289	2944	43.8	IEEE	1289	43.8	International Telecommunication Union	289	9.8
25	Huawei Technologies Compa	1238	4857	25.5	International Telecommunication Union	2057	42.4	IEEE	1238	25.5
26	Canon Inc	1189	3335	35.7	IEEE	1189	35.7	International Telecommunication Union	550	16.5
27	Hon Hai Precision Industry C	1156	3829	30.2	IEEE	1156	30.2	International Telecommunication Union	832	21.7
28	International Business Machi	1153	3758	30.7	IEEE	1153	30.7	Internet Soc/IETF-Internet Eng Task Force	632	16.8
29	NETWORK-1 TECHNOLOG	1076	3052	35.3	IEEE	1076	35.3	ACM-Assoc Comput Mach	727	23.8
30	GoPro Inc	1006	1991	50.5	IEEE	1006	50.5	ACM-Assoc Comput Mach	206	10.3
31	STMicroelectronics	837	1318	63.5	IEEE	837	63.5	RELX Group (Elsevier)	73	5.5
32	Commscope Holding (formerl	810	2308	35.1	IEEE	810	35.1	International Telecommunication Union	292	12.7
33	INTOUCH HEALTH INC	806	2095	38.5	IEEE	806	38.5	Springer Nature	139	6.6
34	Softbank Corp	753	1982	38.0	IEEE	753	38.0	ISO/IEC	178	9.0
35	HP Inc	744	1658	44.9	IEEE	744	44.9	ACM-Assoc Comput Mach	251	15.1
36	Ricoh Co. Ltd.	702	1557	45.1	IEEE	702	45.1	ACM-Assoc Comput Mach	201	12.9
37	Honeywell International Inc.	701	2311	30.3	IEEE	701	30.3	Optical Society of America	443	19.2
38	California Institute of Techno	696	3709	18.8	Optical Society of America	1033	27.9	IEEE	696	18.8
39	Digimarc Corp.	694	1848	37.6	IEEE	694	37.6	SPIE-Int Soc Opt Engineering	318	17.2

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Cortica Ltd	689	1002	68.8	IEEE	689	68.8	ACM-Assoc Comput Mach	124	12.4
41	Wisteria Trading Inc	571	1199	47.6	IEEE	571	47.6	SPIE-Int Soc Opt Engineering	135	11.3
42	Columbia University	546	1192	45.8	IEEE	546	45.8	ACM-Assoc Comput Mach	188	15.8
43	Ericsson	535	2015	26.6	IEEE	535	26.6	International Telecommunication Union	448	22.2
44	Mitsubishi Electric Corp	532	1302	40.9	IEEE	532	40.9	International Telecommunication Union	226	17.4
45	Koninklijke Philips N.V.	521	1226	42.5	IEEE	521	42.5	ACM-Assoc Comput Mach	106	8.6
46	Xerox Corp	520	1301	40.0	IEEE	520	40.0	SPIE-Int Soc Opt Engineering	160	12.3
47	Blackberry Ltd.	510	1227	41.6	IEEE	510	41.6	International Telecommunication Union	194	15.8
48	Amazon.com Inc.	501	1168	42.9	IEEE	501	42.9	ACM-Assoc Comput Mach	203	17.4
49	Motorola Solutions Inc.	499	958	52.1	IEEE	499	52.1	ACM-Assoc Comput Mach	59	6.2
50	Walt Disney Co.	496	1405	35.3	IEEE	496	35.3	ACM-Assoc Comput Mach	427	30.4
51	PixelWorks Inc	472	744	63.4	IEEE	472	63.4	SPIE-Int Soc Opt Engineering	66	8.9
52	Nielsen Holdings Plc	468	2994	15.6	IEEE	468	15.6	RELX Group (Elsevier)	450	15.0
53	Toshiba Corp	465	1480	31.4	International Telecommunication Union	493	33.3	IEEE	465	31.4
54	Verance Corp	439	931	47.2	IEEE	439	47.2	SPIE-Int Soc Opt Engineering	123	13.2
55	Nippon Telegraph & Telepho	438	1493	29.3	International Telecommunication Union	448	30.0	IEEE	438	29.3
56	Industrial Technology Researc	434	709	61.2	IEEE	434	61.2	SPIE-Int Soc Opt Engineering	50	7.1
57	Electronics and Telecommuni	431	2015	21.4	International Telecommunication Union	1084	53.8	IEEE	431	21.4
58	Fujifilm Business Innovation	430	1256	34.2	IEEE	430	34.2	ACM-Assoc Comput Mach	311	24.8
59	Texas Instruments Inc	413	1982	20.8	International Telecommunication Union	1300	65.6	IEEE	413	20.8
60	ACACIA MEDIA TECHNO	408	738	55.3	IEEE	408	55.3	ACM-Assoc Comput Mach	66	8.9
61	NEC Corp	391	1030	38.0	IEEE	391	38.0	International Telecommunication Union	166	16.1
62	Semiconductor Energy Labor	384	4802	8.0	SID-Society for Information Display	1678	34.9	American Institute of Physics	594	12.4
63	SUN PATENT TRUST	368	5952	6.2	International Telecommunication Union	4600	77.3	IEEE	368	6.2
64	Marvell Technology Group Lt	366	450	81.3	IEEE	366	81.3	ACM-Assoc Comput Mach	9	2.0
65	On Semiconductor Corporati	355	513	69.2	IEEE	355	69.2	SPIE-Int Soc Opt Engineering	54	10.5
66	Mediatek Inc.	350	1943	18.0	International Telecommunication Union	1076	55.4	IEEE	350	18.0
67	NVIDIA Corp.	349	841	41.5	IEEE	349	41.5	ACM-Assoc Comput Mach	131	15.6
68	Twitter Inc	316	498	63.5	IEEE	316	63.5	ACM-Assoc Comput Mach	39	7.8
69	ECOLE DE TECHBOLOGIE	315	537	58.7	IEEE	315	58.7	3GPP General Partnership Project Standards Body	52	9.7
70	Comcast Corp	314	1341	23.4	IEEE	314	23.4	ACM-Assoc Comput Mach	253	18.9
71	Omnivision Technologies Inc	313	517	60.5	IEEE	313	60.5	SPIE-Int Soc Opt Engineering	67	13.0
72	Align Technology Inc	311	2592	12.0	JCO - Journal of Clinical Orthodontics	333	12.8	RELX Group (Elsevier)	314	12.1
73	Intellectual Ventures Manage	304	1190	25.5	IEEE	304	25.5	ACM-Assoc Comput Mach	165	13.9
74	BLACK HILLS MEDIA LLC	295	1799	16.4	Open Connectivity Foundation	1025	57.0	IEEE	295	16.4
75	REARDEN LLC	294	453	64.9	IEEE	294	64.9	Optical Society of America	41	9.1
76	Tencent Holding Ltd	288	1156	24.9	International Telecommunication Union	525	45.4	IEEE	288	24.9
77	Witricity Corp	288	532	54.1	IEEE	288	54.1	American Institute of Physics	36	6.8
78	University of Minnesota (The	280	408	68.6	IEEE	280	68.6	SAGE Publications Ltd	24	5.9
79	EUCLID DISCOVERIES LL	270	543	49.7	IEEE	270	49.7	RELX Group (Elsevier)	136	25.0
80	Micron Technology Inc.	270	461	58.6	IEEE	270	58.6	SPIE-Int Soc Opt Engineering	56	12.1

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Walmart Stores Inc	263	737	35.7	IEEE	263	35.7	CBS Interactive	82	11.1
82	Ostendo Technologies Inc	260	869	29.9	IEEE	260	29.9	SPIE-Int Soc Opt Engineering	143	16.5
83	Meta Platforms Inc.(formerly	259	747	34.7	IEEE	259	34.7	ACM-Assoc Comput Mach	136	18.2
84	BT Group PLC	252	475	53.1	IEEE	252	53.1	RELX Group (Elsevier)	40	8.4
85	University of California	245	629	39.0	IEEE	245	39.0	RELX Group (Elsevier)	50	7.9
86	Advanced Micro Devices Inc	243	401	60.6	IEEE	243	60.6	ACM-Assoc Comput Mach	21	5.2
87	United States Navy	243	558	43.5	IEEE	243	43.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	61	10.9
88	University of North Carolina	243	650	37.4	IEEE	243	37.4	ACM-Assoc Comput Mach	165	25.4
89	University of Washington	241	720	33.5	IEEE	241	33.5	SPIE-Int Soc Opt Engineering	104	14.4
90	ARC DEVICES LTD	240	1097	21.9	ACM-Assoc Comput Mach	448	40.8	IEEE	240	21.9
91	CONVERGENT MEDIA SO	240	1049	22.9	ACM-Assoc Comput Mach	257	24.5	IEEE	240	22.9
92	FACENSE LTD	236	430	54.9	IEEE	236	54.9	RELX Group (Elsevier)	60	14.0
93	Ford Motor Co.	236	491	48.1	IEEE	236	48.1	SAE-Society of Automobile Engineers	45	9.2
94	Raytheon Co.	232	611	38.0	IEEE	232	38.0	SPIE-Int Soc Opt Engineering	104	17.0
95	Dish Network Corp	231	452	51.1	IEEE	231	51.1	RELX Group (Elsevier)	45	10.0
96	The Arizona Board of Regent	229	1274	18.0	Optical Society of America	350	27.5	IEEE	229	18.0
97	Seiko Epson Corporation	228	485	47.0	IEEE	228	47.0	ACM-Assoc Comput Mach	44	9.1
98	EchoStar Corp	225	593	37.9	IEEE	225	37.9	ACM-Assoc Comput Mach	51	8.6
99	ByteDance Ltd	223	2250	9.9	International Telecommunication Union	1722	76.5	IEEE	223	9.9
100	Siemens Aktiengesellschaft	222	510	43.5	IEEE	222	43.5	International Telecommunication Union	59	11.6

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Computer Hardware</i>										
1	International Business Machi	20420	75970	26.9	IEEE	20420	26.9	ACM-Assoc Comput Mach	16383	21.6
2	Microsoft Corporation	17505	69470	25.2	ACM-Assoc Comput Mach	23965	34.5	IEEE	17505	25.2
3	Apple Inc	13377	47526	28.1	ACM-Assoc Comput Mach	14197	29.9	IEEE	13377	28.1
4	Intel Corporation	10826	23516	46.0	IEEE	10826	46.0	ACM-Assoc Comput Mach	3121	13.3
5	Alphabet Inc.	5956	20249	29.4	IEEE	5956	29.4	ACM-Assoc Comput Mach	5009	24.7
6	Oracle Corporation	4752	17816	26.7	ACM-Assoc Comput Mach	6227	35.0	IEEE	4752	26.7
7	Samsung Electronics Co Ltd	4424	11605	38.1	IEEE	4424	38.1	ACM-Assoc Comput Mach	1129	9.7
8	Broadcom Ltd	3955	6955	56.9	IEEE	3955	56.9	ACM-Assoc Comput Mach	626	9.0
9	Immersion Corp.	3502	10013	35.0	IEEE	3502	35.0	ACM-Assoc Comput Mach	1070	10.7
10	Cadence Design Systems Inc	3467	8641	40.1	IEEE	3467	40.1	Joint IEEE and ACM	3090	35.8
11	Qualcomm Inc	3448	8830	39.0	IEEE	3448	39.0	ACM-Assoc Comput Mach	721	8.2
12	Sony Group Corp	3193	7697	41.5	IEEE	3193	41.5	ACM-Assoc Comput Mach	1117	14.5
13	Advanced Micro Devices Inc	3068	8617	35.6	IEEE	3068	35.6	ACM-Assoc Comput Mach	2666	30.9
14	OneTrust	2711	9230	29.4	ACM-Assoc Comput Mach	4778	51.8	IEEE	2711	29.4
15	Canon Inc	2503	6389	39.2	IEEE	2503	39.2	RELX Group (Elsevier)	547	8.6
16	Ricoh Co. Ltd.	2400	5144	46.7	IEEE	2400	46.7	ACM-Assoc Comput Mach	900	17.5
17	HP Inc	2191	6913	31.7	IEEE	2191	31.7	ACM-Assoc Comput Mach	1490	21.6
18	Commvault Systems Inc.	2148	3576	60.1	IEEE	2148	60.1	ACM-Assoc Comput Mach	586	16.4
19	Nokia Corporation	2131	5602	38.0	IEEE	2131	38.0	ACM-Assoc Comput Mach	813	14.5
20	Micron Technology Inc.	2069	3857	53.6	IEEE	2069	53.6	ACM-Assoc Comput Mach	305	7.9
21	Fujitsu Limited	2019	5349	37.7	IEEE	2019	37.7	ACM-Assoc Comput Mach	650	12.2
22	Cisco Systems Inc.	1915	6234	30.7	IEEE	1915	30.7	Internet Soc/IETF-Internet Eng Task Force	949	15.2
23	Siemens Aktiengesellschaft	1911	4199	45.5	IEEE	1911	45.5	Joint IEEE and ACM	478	11.4
24	MicroUnity Systems Enginee	1857	3057	60.7	IEEE	1857	60.7	Joint IEEE and ACM	267	8.7
25	AT&T Inc	1843	5214	35.3	IEEE	1843	35.3	ACM-Assoc Comput Mach	1073	20.6
26	Xperi Holding Corporation (F	1661	3878	42.8	IEEE	1661	42.8	ACM-Assoc Comput Mach	285	7.3
27	Rambus Inc.	1621	2328	69.6	IEEE	1621	69.6	JEDEC Semiconductor Standards Organization	116	5.0
28	Personalized Media Commun	1607	10379	15.5	Society of Motion Picture and Television Engi	3113	30.0	IEEE	1607	15.5
29	Infineon Technologies AG	1579	2677	59.0	IEEE	1579	59.0	Joint IEEE and ACM	312	11.7
30	IP RESERVOIR LLC	1578	3098	50.9	IEEE	1578	50.9	ACM-Assoc Comput Mach	521	16.8
31	Panasonic Corporation	1548	3861	40.1	IEEE	1548	40.1	International Telecommunication Union	316	8.2
32	Ignis Innovation Inc	1520	2180	69.7	IEEE	1520	69.7	SID-Society for Information Display	380	17.4
33	Honeywell International Inc.	1516	4023	37.7	IEEE	1516	37.7	RELX Group (Elsevier)	308	7.7
34	Dell Technologies Inc	1472	4224	34.8	IEEE	1472	34.8	ACM-Assoc Comput Mach	881	20.9
35	Columbia University	1439	5670	25.4	IEEE	1439	25.4	ACM-Assoc Comput Mach	1169	20.6
36	Amazon.com Inc.	1421	5561	25.6	ACM-Assoc Comput Mach	1729	31.1	IEEE	1421	25.6
37	NEC Corp	1404	3556	39.5	IEEE	1404	39.5	ACM-Assoc Comput Mach	507	14.3
38	Sonos Inc	1368	3362	40.7	IEEE	1368	40.7	SPIE-Int Soc Opt Engineering	373	11.1
39	Synopsys Inc.	1356	3577	37.9	IEEE	1356	37.9	Joint IEEE and ACM	752	21.0

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Toshiba Corp	1323	3166	41.8	IEEE	1323	41.8	ACM-Assoc Comput Mach	216	6.8
41	Sap SE	1303	5134	25.4	ACM-Assoc Comput Mach	1667	32.5	IEEE	1303	25.4
42	Semiconductor Energy Labor	1290	19543	6.6	SID-Society for Information Display	7360	37.7	American Institute of Physics	2420	12.4
43	Marvell Technology Group Lt	1217	1842	66.1	IEEE	1217	66.1	ACM-Assoc Comput Mach	130	7.1
44	Huawei Technologies Compa	1207	3997	30.2	IEEE	1207	30.2	3GPP General Partnership Project Standards Body	507	12.7
45	PACT XPP TECHNOLOGIE	1200	2047	58.6	IEEE	1200	58.6	ACM-Assoc Comput Mach	194	9.5
46	Fraunhofer Gesellschaft	1168	2962	39.4	IEEE	1168	39.4	Audio Eng Soc	466	15.7
47	STMicroelectronics	1115	2036	54.8	IEEE	1115	54.8	ACM-Assoc Comput Mach	114	5.6
48	Adobe Inc. (former Adobe Sy	1092	3788	28.8	ACM-Assoc Comput Mach	1549	40.9	IEEE	1092	28.8
49	FireEye Inc	1079	3111	34.7	IEEE	1079	34.7	ACM-Assoc Comput Mach	560	18.0
50	Blackberry Ltd.	1075	2867	37.5	IEEE	1075	37.5	ACM-Assoc Comput Mach	387	13.5
51	Softbank Corp	1041	2472	42.1	IEEE	1041	42.1	Joint IEEE and ACM	366	14.8
52	P4TENTS1 LLC	1036	2431	42.6	IEEE	1036	42.6	ACM-Assoc Comput Mach	354	14.6
53	Xerox Corp	1018	4164	24.4	ACM-Assoc Comput Mach	1059	25.4	IEEE	1018	24.4
54	NVIDIA Corp.	992	2510	39.5	IEEE	992	39.5	ACM-Assoc Comput Mach	600	23.9
55	Seiko Epson Corporation	984	2898	34.0	IEEE	984	34.0	Joint IEEE and ACM	357	12.3
56	Hitachi Ltd	978	3492	28.0	IEEE	978	28.0	ACM-Assoc Comput Mach	579	16.6
57	Massachusetts Institute of Te	910	2264	40.2	IEEE	910	40.2	ACM-Assoc Comput Mach	392	17.3
58	Technicolor SA	905	1799	50.3	IEEE	905	50.3	ACM-Assoc Comput Mach	166	9.2
59	Tabula Inc	873	2330	37.5	IEEE	873	37.5	ACM-Assoc Comput Mach	864	37.1
60	Western Digital Corp.	866	2434	35.6	IEEE	866	35.6	ACM-Assoc Comput Mach	331	13.6
61	Texas A&M University	847	955	88.7	IEEE	847	88.7	IET/IEE	16	1.7
62	Texas Instruments Inc	847	1516	55.9	IEEE	847	55.9	Joint IEEE and ACM	135	8.9
63	Hewlett Packard Enterprises	826	2641	31.3	IEEE	826	31.3	ACM-Assoc Comput Mach	719	27.2
64	Intellectual Ventures Manage	801	3434	23.3	IEEE	801	23.3	ACM-Assoc Comput Mach	524	15.3
65	The Arizona Board of Regent	797	2206	36.1	IEEE	797	36.1	ACM-Assoc Comput Mach	196	8.9
66	NXP Semiconductors NV	788	1397	56.4	IEEE	788	56.4	Joint IEEE and ACM	178	12.7
67	SRC Computers Inc.	773	866	89.3	IEEE	773	89.3	ACM-Assoc Comput Mach	29	3.3
68	Meta Platforms Inc.(formerly	763	2753	27.7	ACM-Assoc Comput Mach	763	27.7	IEEE	763	27.7
69	Hon Hai Precision Industry C	753	3245	23.2	IEEE	753	23.2	SID-Society for Information Display	462	14.2
70	Brain Corporation	749	2432	30.8	IEEE	749	30.8	MIT Press	360	14.8
71	General Electric Company	747	1815	41.2	IEEE	747	41.2	RELX Group (Elsevier)	199	11.0
72	LG Electronics Inc.	718	2494	28.8	IEEE	718	28.8	3GPP General Partnership Project Standards Body	360	14.4
73	Fujifilm Business Innovation	713	2192	32.5	IEEE	713	32.5	ACM-Assoc Comput Mach	538	24.5
74	Tela Innovations inc	710	1926	36.9	IEEE	710	36.9	SPIE-Int Soc Opt Engineering	585	30.4
75	Citrix Systems Inc	673	1983	33.9	IEEE	673	33.9	ACM-Assoc Comput Mach	300	15.1
76	Empire Technology Develop	671	2110	31.8	IEEE	671	31.8	Joint IEEE and ACM	639	30.3
77	Netapp Inc	670	3443	19.5	ACM-Assoc Comput Mach	1366	39.7	IEEE	670	19.5
78	University of California	656	3385	19.4	IEEE	656	19.4	RELX Group (Elsevier)	401	11.8
79	HRL Laboratories LLC	653	1782	36.6	IEEE	653	36.6	ACM-Assoc Comput Mach	192	10.8
80	Mitsubishi Electric Corp	649	1445	44.9	IEEE	649	44.9	ACM-Assoc Comput Mach	232	16.1

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Ericsson	641	2192	29.2	IEEE	641	29.2	3GPP General Partnership Project Standards Body	329	15.0
82	Koninklijke Philips N.V.	641	1753	36.6	IEEE	641	36.6	RELX Group (Elsevier)	168	9.6
83	Wave Computing Inc.	629	2088	30.1	IEEE	629	30.1	ACM-Assoc Comput Mach	377	18.1
84	Math Works Inc (The)	617	1572	39.2	IEEE	617	39.2	ACM-Assoc Comput Mach	346	22.0
85	Raytheon Co.	606	1730	35.0	IEEE	606	35.0	ACM-Assoc Comput Mach	153	8.8
86	Industrial Technology Researc	604	1219	49.5	IEEE	604	49.5	ACM-Assoc Comput Mach	119	9.8
87	Digimarc Corp.	599	1676	35.7	IEEE	599	35.7	ACM-Assoc Comput Mach	295	17.6
88	Conversant Intellectual Prope	591	839	70.4	IEEE	591	70.4	Joint IEEE and ACM	54	6.4
89	Murata Manufacturing Co. Lt	589	767	76.8	IEEE	589	76.8	RELX Group (Elsevier)	30	3.9
90	Silverbrook Pty Ltd	585	1468	39.9	IEEE	585	39.9	Springer Nature	287	19.6
91	Electronics and Telecommuni	583	1318	44.2	IEEE	583	44.2	ACM-Assoc Comput Mach	133	10.1
92	Irobot Corp	573	1123	51.0	IEEE	573	51.0	SPIE-Int Soc Opt Engineering	231	20.6
93	Nippon Telegraph & Telepho	555	1929	28.8	IEEE	555	28.8	ACM-Assoc Comput Mach	214	11.1
94	VMWare Inc	550	2588	21.3	ACM-Assoc Comput Mach	1078	41.7	IEEE	550	21.3
95	Washington University in St.	542	1320	41.1	IEEE	542	41.1	ACM-Assoc Comput Mach	141	10.7
96	National Instruments Corp.	537	1026	52.3	IEEE	537	52.3	ACM-Assoc Comput Mach	118	11.5
97	INDIVIDUAL PATENTER	536	2579	20.8	IEEE	536	20.8	RELX Group (Elsevier)	330	12.8
98	Cortica Ltd	530	775	68.4	IEEE	530	68.4	ACM-Assoc Comput Mach	93	12.0
99	Magic Leap Inc	519	1298	40.0	IEEE	519	40.0	ACM-Assoc Comput Mach	138	10.6
100	ABB Ltd	511	801	63.8	IEEE	511	63.8	IVI Foundation/SCPI Consortium	93	11.6

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Computer Software</i>										
1	Microsoft Corporation	31882	97744	32.6	IEEE	31882	32.6	ACM-Assoc Comput Mach	26268	26.9
2	Apple Inc	21803	62032	35.1	IEEE	21803	35.1	ACM-Assoc Comput Mach	12777	20.6
3	International Business Machi	17562	65222	26.9	IEEE	17562	26.9	ACM-Assoc Comput Mach	13443	20.6
4	Alphabet Inc.	10812	33908	31.9	IEEE	10812	31.9	ACM-Assoc Comput Mach	7919	23.4
5	Xperi Holding Corporation (F	5124	10970	46.7	IEEE	5124	46.7	ACM-Assoc Comput Mach	1036	9.4
6	Oracle Corporation	4491	18548	24.2	ACM-Assoc Comput Mach	5863	31.6	IEEE	4491	24.2
7	Adobe Inc. (former Adobe Sy	4371	11402	38.3	IEEE	4371	38.3	ACM-Assoc Comput Mach	3671	32.2
8	Intel Corporation	3523	8109	43.4	IEEE	3523	43.4	ACM-Assoc Comput Mach	1537	19.0
9	Qualcomm Inc	3520	8404	41.9	IEEE	3520	41.9	3GPP General Partnership Project Standards Body	476	5.7
10	Siemens Aktiengesellschaft	3485	9170	38.0	IEEE	3485	38.0	SPIE-Int Soc Opt Engineering	1027	11.2
11	Cisco Systems Inc.	2835	9643	29.4	IEEE	2835	29.4	ACM-Assoc Comput Mach	1765	18.3
12	Amazon.com Inc.	2704	10648	25.4	IEEE	2704	25.4	ACM-Assoc Comput Mach	2681	25.2
13	AT&T Inc	2632	6775	38.8	IEEE	2632	38.8	ACM-Assoc Comput Mach	994	14.7
14	Xerox Corp	2570	7917	32.5	IEEE	2570	32.5	ACM-Assoc Comput Mach	1553	19.6
15	Dolby Laboratories Inc	2537	5217	48.6	IEEE	2537	48.6	Audio Eng Soc	896	17.2
16	Sap SE	2338	11092	21.1	ACM-Assoc Comput Mach	3947	35.6	IEEE	2338	21.1
17	Ricoh Co. Ltd.	2236	4955	45.1	IEEE	2236	45.1	ACM-Assoc Comput Mach	806	16.3
18	HP Inc	2153	5731	37.6	IEEE	2153	37.6	ACM-Assoc Comput Mach	1278	22.3
19	Koninklijke Philips N.V.	2135	7955	26.8	IEEE	2135	26.8	RELX Group (Elsevier)	986	12.4
20	Commvault Systems Inc.	2034	3391	60.0	IEEE	2034	60.0	ACM-Assoc Comput Mach	533	15.7
21	General Electric Company	1835	4128	44.5	IEEE	1835	44.5	RELX Group (Elsevier)	388	9.4
22	Sony Group Corp	1812	3895	46.5	IEEE	1812	46.5	ACM-Assoc Comput Mach	631	16.2
23	Cadence Design Systems Inc	1797	3749	47.9	IEEE	1797	47.9	Joint IEEE and ACM	1059	28.2
24	Digimarc Corp.	1778	4643	38.3	IEEE	1778	38.3	SPIE-Int Soc Opt Engineering	725	15.6
25	Nokia Corporation	1744	4818	36.2	IEEE	1744	36.2	ACM-Assoc Comput Mach	495	10.3
26	Broadcom Ltd	1714	3604	47.6	IEEE	1714	47.6	ACM-Assoc Comput Mach	361	10.0
27	Synopsys Inc.	1698	5678	29.9	IEEE	1698	29.9	SPIE-Int Soc Opt Engineering	1286	22.6
28	Advanced Micro Devices Inc	1667	6886	24.2	ACM-Assoc Comput Mach	3191	46.3	IEEE	1667	24.2
29	Cognex Corp.	1617	3749	43.1	IEEE	1617	43.1	RELX Group (Elsevier)	698	18.6
30	Magna International Inc.	1578	2831	55.7	IEEE	1578	55.7	SAE-Society of Automobile Engineers	208	7.3
31	HRL Laboratories LLC	1490	3484	42.8	IEEE	1490	42.8	RELX Group (Elsevier)	296	8.5
32	Irobot Corp	1469	2661	55.2	IEEE	1469	55.2	SPIE-Int Soc Opt Engineering	410	15.4
33	Honeywell International Inc.	1439	2729	52.7	IEEE	1439	52.7	RELX Group (Elsevier)	242	8.9
34	Accenture Ltd.	1387	4325	32.1	IEEE	1387	32.1	ACM-Assoc Comput Mach	669	15.5
35	NVIDIA Corp.	1383	4520	30.6	ACM-Assoc Comput Mach	1549	34.3	IEEE	1383	30.6
36	Applied Materials Inc.	1315	2330	56.4	IEEE	1315	56.4	American Institute of Physics	129	5.5
37	Cortica Ltd	1270	1845	68.8	IEEE	1270	68.8	ACM-Assoc Comput Mach	206	11.2
38	Meta Platforms Inc.(formerly	1246	4837	25.8	ACM-Assoc Comput Mach	1418	29.3	IEEE	1246	25.8
39	Blackberry Ltd.	1243	3551	35.0	IEEE	1243	35.0	ACM-Assoc Comput Mach	323	9.1

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Intuitive Surgical Inc.	1197	2712	44.1	IEEE	1197	44.1	The Medical Image Computing and Computer Assisted Interv	282	10.4
41	NEC Corp	1177	2966	39.7	IEEE	1177	39.7	ACM-Assoc Comput Mach	439	14.8
42	Walt Disney Co.	1173	4929	23.8	ACM-Assoc Comput Mach	2397	48.6	IEEE	1173	23.8
43	Honda Motor Co. Ltd.(Honda	1167	2326	50.2	IEEE	1167	50.2	RELX Group (Elsevier)	242	10.4
44	Samsung Electronics Co Ltd	1079	2447	44.1	IEEE	1079	44.1	ACM-Assoc Comput Mach	221	9.0
45	PHOENIX SOLUTIONS INC	1070	3212	33.3	IEEE	1070	33.3	ISCA (International Speech Communication Association)	422	13.1
46	eBay Inc	1061	5647	18.8	IEEE	1061	18.8	ACM-Assoc Comput Mach	749	13.3
47	Raytheon Co.	1061	2460	43.1	IEEE	1061	43.1	SPIE-Int Soc Opt Engineering	186	7.6
48	Intellectual Ventures Manage	1031	5578	18.5	IEEE	1031	18.5	RELX Group (Elsevier)	615	11.0
49	Sonos Inc	1011	2590	39.0	IEEE	1011	39.0	SPIE-Int Soc Opt Engineering	296	11.4
50	MicroUnity Systems Enginee	939	1521	61.7	IEEE	939	61.7	Joint IEEE and ACM	140	9.2
51	Fraunhofer Gesellschaft	934	2303	40.6	IEEE	934	40.6	Audio Eng Soc	304	13.2
52	Canon Inc	915	2155	42.5	IEEE	915	42.5	RELX Group (Elsevier)	206	9.6
53	Massachusetts Institute of Te	883	2952	29.9	IEEE	883	29.9	ACM-Assoc Comput Mach	307	10.4
54	Ericsson	879	2936	29.9	IEEE	879	29.9	3GPP General Partnership Project Standards Body	413	14.1
55	LG Electronics Inc.	858	1915	44.8	IEEE	858	44.8	Audio Eng Soc	139	7.3
56	STMicroelectronics	856	1444	59.3	IEEE	856	59.3	RELX Group (Elsevier)	95	6.6
57	Boeing Co. (The)	823	2517	32.7	IEEE	823	32.7	RELX Group (Elsevier)	338	13.4
58	Nippon Telegraph & Telepho	794	2775	28.6	IEEE	794	28.6	ACM-Assoc Comput Mach	347	12.5
59	Magic Leap Inc	792	1410	56.2	IEEE	792	56.2	ACM-Assoc Comput Mach	132	9.4
60	ParkerVision Inc	792	1713	46.2	IEEE	792	46.2	IET/IEE	491	28.7
61	Mitsubishi Electric Corp	785	1665	47.1	IEEE	785	47.1	ACM-Assoc Comput Mach	352	21.1
62	Dell Technologies Inc	775	2606	29.7	IEEE	775	29.7	ACM-Assoc Comput Mach	528	20.3
63	Motorola Solutions Inc.	769	1251	61.5	IEEE	769	61.5	Springer Nature	75	6.0
64	Palantir Technologies Inc	761	3582	21.2	ACM-Assoc Comput Mach	806	22.5	IEEE	761	21.2
65	Battelle Memorial Institute	748	1201	62.3	IEEE	748	62.3	RELX Group (Elsevier)	111	9.2
66	University of California	741	4723	15.7	IEEE	741	15.7	RELX Group (Elsevier)	611	12.9
67	Panasonic Corporation	707	1457	48.5	IEEE	707	48.5	ACM-Assoc Comput Mach	107	7.3
68	Tela Innovations inc	706	2316	30.5	SPIE-Int Soc Opt Engineering	882	38.1	IEEE	706	30.5
69	Huawei Technologies Compa	704	2173	32.4	IEEE	704	32.4	3GPP General Partnership Project Standards Body	214	9.8
70	Fujitsu Limited	701	1982	35.4	IEEE	701	35.4	Joint IEEE and ACM	368	18.6
71	Bosch (Robert) GmbH	672	3994	16.8	IEEE	672	16.8	Springer Nature	378	9.5
72	Columbia University	664	2337	28.4	IEEE	664	28.4	ACM-Assoc Comput Mach	397	17.0
73	Technicolor SA	653	1435	45.5	IEEE	653	45.5	ACM-Assoc Comput Mach	124	8.6
74	The Arizona Board of Regent	632	1686	37.5	IEEE	632	37.5	RELX Group (Elsevier)	185	11.0
75	Eagleview Technologies Inc	615	2175	28.3	IEEE	615	28.3	ACM-Assoc Comput Mach	439	20.2
76	Lumens Technologies Inc. (fo	599	2468	24.3	ACM-Assoc Comput Mach	697	28.2	IEEE	599	24.3
77	Hon Hai Precision Industry C	596	1336	44.6	IEEE	596	44.6	ACM-Assoc Comput Mach	138	10.3
78	BT Group PLC	590	1283	46.0	IEEE	590	46.0	ACM-Assoc Comput Mach	127	9.9
79	SalesforceCom Inc	576	1856	31.0	IEEE	576	31.0	ACM-Assoc Comput Mach	346	18.6
80	Citrix Systems Inc	573	1851	31.0	IEEE	573	31.0	ACM-Assoc Comput Mach	331	17.9

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Hewlett Packard Enterprises	573	2089	27.4	IEEE	573	27.4	ACM-Assoc Comput Mach	570	27.3
82	IP RESERVOIR LLC	560	1090	51.4	IEEE	560	51.4	ACM-Assoc Comput Mach	193	17.7
83	INDIVIDUAL PATENTER	556	2772	20.1	IEEE	556	20.1	ACM-Assoc Comput Mach	421	15.2
84	Nant Holdings IP Llc	553	2585	21.4	Joint IEEE and ACM	851	32.9	ACM-Assoc Comput Mach	649	25.1
85	Yahoo Inc	540	3891	13.9	ACM-Assoc Comput Mach	1167	30.0	IEEE	540	13.9
86	Texas Instruments Inc	539	862	62.5	IEEE	539	62.5	International Telecommunication Union	85	9.9
87	Verizon Communications Inc	536	2016	26.6	IEEE	536	26.6	ACM-Assoc Comput Mach	346	17.2
88	Seiko Epson Corporation	534	1064	50.2	IEEE	534	50.2	ACM-Assoc Comput Mach	112	10.5
89	United States Navy	519	1121	46.3	IEEE	519	46.3	RELX Group (Elsevier)	91	8.1
90	Math Works Inc (The)	513	1216	42.2	IEEE	513	42.2	ACM-Assoc Comput Mach	210	17.3
91	Lockheed Martin Corp.	512	1174	43.6	IEEE	512	43.6	RELX Group (Elsevier)	109	9.3
92	Eastman Kodak Company	511	1130	45.2	IEEE	511	45.2	RELX Group (Elsevier)	104	9.2
93	University of North Carolina	498	1678	29.7	IEEE	498	29.7	ACM-Assoc Comput Mach	246	14.7
94	Infineon Technologies AG	496	778	63.8	IEEE	496	63.8	Joint IEEE and ACM	91	11.7
95	Toyota Motor Corp	496	938	52.9	IEEE	496	52.9	RELX Group (Elsevier)	76	8.1
96	Hitachi Ltd	485	2207	22.0	IEEE	485	22.0	ACM-Assoc Comput Mach	353	16.0
97	SRI International	482	1078	44.7	IEEE	482	44.7	RELX Group (Elsevier)	61	5.7
98	Marvell Technology Group Lt	479	670	71.5	IEEE	479	71.5	ACM-Assoc Comput Mach	40	6.0
99	Nielsen Holdings Plc	479	4197	11.4	RELX Group (Elsevier)	888	21.2	IEEE	479	11.4
100	OneTrust	479	1602	29.9	ACM-Assoc Comput Mach	810	50.6	IEEE	479	29.9

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Cybersecurity</i>										
1	Microsoft Corporation	6939	26050	26.6	IEEE	6939	26.6	ACM-Assoc Comput Mach	6329	24.3
2	International Business Machi	5864	25356	23.1	IEEE	5864	23.1	ACM-Assoc Comput Mach	4828	19.0
3	Cisco Systems Inc.	3960	13874	28.5	IEEE	3960	28.5	ACM-Assoc Comput Mach	2103	15.2
4	OneTrust	3635	12347	29.4	ACM-Assoc Comput Mach	6385	51.7	IEEE	3635	29.4
5	FireEye Inc	2391	6763	35.4	IEEE	2391	35.4	ACM-Assoc Comput Mach	1230	18.2
6	Intel Corporation	2088	5537	37.7	IEEE	2088	37.7	ACM-Assoc Comput Mach	619	11.2
7	Blackberry Ltd.	2008	7646	26.3	IEEE	2008	26.3	3GPP General Partnership Project Standards Body	798	10.4
8	Alphabet Inc.	2003	6746	29.7	IEEE	2003	29.7	ACM-Assoc Comput Mach	1333	19.8
9	Oracle Corporation	1742	7691	22.6	IEEE	1742	22.6	ACM-Assoc Comput Mach	1635	21.3
10	AT&T Inc	1545	4501	34.3	IEEE	1545	34.3	ACM-Assoc Comput Mach	511	11.4
11	Columbia University	1498	6407	23.4	IEEE	1498	23.4	ACM-Assoc Comput Mach	1221	19.1
12	Intertrust Technologies Corp	1393	8876	15.7	ACM-Assoc Comput Mach	1583	17.8	IEEE	1393	15.7
13	Massachusetts Institute of Te	1337	2308	57.9	IEEE	1337	57.9	ACM-Assoc Comput Mach	246	10.7
14	Apple Inc	1332	4249	31.3	IEEE	1332	31.3	ACM-Assoc Comput Mach	894	21.0
15	Wisteria Trading Inc	1326	2758	48.1	IEEE	1326	48.1	SPIE-Int Soc Opt Engineering	326	11.8
16	Amazon.com Inc.	1120	4857	23.1	IEEE	1120	23.1	ACM-Assoc Comput Mach	770	15.9
17	Nokia Corporation	1109	5140	21.6	3GPP General Partnership Project Standards B	1330	25.9	IEEE	1109	21.6
18	X ONE INC	1017	2804	36.3	IEEE	1017	36.3	ACM-Assoc Comput Mach	505	18.0
19	Citrix Systems Inc	1013	2944	34.4	IEEE	1013	34.4	ACM-Assoc Comput Mach	359	12.2
20	Qualcomm Inc	943	3746	25.2	3GPP General Partnership Project Standards B	1021	27.3	IEEE	943	25.2
21	McAfee Inc	917	3974	23.1	IEEE	917	23.1	ACM-Assoc Comput Mach	758	19.1
22	InterDigital Inc	900	4105	21.9	3GPP General Partnership Project Standards B	2725	66.4	IEEE	900	21.9
23	Nippon Telegraph & Telepho	861	4288	20.1	IEEE	861	20.1	ACM-Assoc Comput Mach	550	12.8
24	Digimarc Corp.	860	2402	35.8	IEEE	860	35.8	ACM-Assoc Comput Mach	265	11.0
25	Norton Lifelock (formerly Sy	859	3178	27.0	IEEE	859	27.0	ACM-Assoc Comput Mach	671	21.1
26	Headwater Partners 1 LLC	793	1878	42.2	IEEE	793	42.2	3GPP General Partnership Project Standards Body	367	19.5
27	IP RESERVOIR LLC	775	1480	52.4	IEEE	775	52.4	ACM-Assoc Comput Mach	221	14.9
28	Huawei Technologies Compa	771	4378	17.6	3GPP General Partnership Project Standards B	1814	41.4	IEEE	771	17.6
29	Juniper Networks Inc.	767	1726	44.4	IEEE	767	44.4	Internet Soc/IETF-Internet Eng Task Force	342	19.8
30	Broadcom Ltd	744	2184	34.1	IEEE	744	34.1	Network Working Group RFC	299	13.7
31	Ericsson	716	5030	14.2	3GPP General Partnership Project Standards B	2025	40.3	IEEE	716	14.2
32	Verizon Communications Inc	698	2381	29.3	IEEE	698	29.3	Internet Soc/IETF-Internet Eng Task Force	558	23.4
33	NXGEN PARTNERS IP LLC	679	1322	51.4	IEEE	679	51.4	Optical Society of America	334	25.3
34	Xerox Corp	669	2154	31.1	IEEE	669	31.1	ACM-Assoc Comput Mach	636	29.5
35	Marvell Technology Group Lt	647	1007	64.3	IEEE	647	64.3	ACM-Assoc Comput Mach	67	6.7
36	Dell Technologies Inc	630	2262	27.9	IEEE	630	27.9	ACM-Assoc Comput Mach	468	20.7
37	Sony Group Corp	622	1744	35.7	IEEE	622	35.7	ACM-Assoc Comput Mach	186	10.7
38	VirnetX Holding Corp	586	11780	5.0	Network Working Group RFC	6287	53.4	Internet Soc/IETF-Internet Eng Task Force	1810	15.4
39	Verance Corp	583	1166	50.0	IEEE	583	50.0	SPIE-Int Soc Opt Engineering	156	13.4

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Samsung Electronics Co Ltd	574	1757	32.7	IEEE	574	32.7	3GPP General Partnership Project Standards Body	527	30.0
41	Raytheon Co.	554	1926	28.8	IEEE	554	28.8	ACM-Assoc Comput Mach	233	12.1
42	Extreme Networks Inc	532	1193	44.6	IEEE	532	44.6	ACM-Assoc Comput Mach	146	12.2
43	Commvault Systems Inc.	509	862	59.0	IEEE	509	59.0	ACM-Assoc Comput Mach	128	14.8
44	CENTRIPETAL NETWORK	496	1421	34.9	IEEE	496	34.9	ACM-Assoc Comput Mach	267	18.8
45	Softbank Corp	493	1768	27.9	IEEE	493	27.9	Virus Bulletin Ltd	261	14.8
46	HP Inc	467	1759	26.5	IEEE	467	26.5	ACM-Assoc Comput Mach	285	16.2
47	Fortinet Inc	454	937	48.5	IEEE	454	48.5	ACM-Assoc Comput Mach	172	18.4
48	L3 Harris Technologies (form	448	766	58.5	IEEE	448	58.5	ACM-Assoc Comput Mach	55	7.2
49	NXP Semiconductors NV	431	803	53.7	IEEE	431	53.7	International Association for Cryptologic Research (IACR)	70	8.7
50	The Arizona Board of Regent	429	1194	35.9	IEEE	429	35.9	ACM-Assoc Comput Mach	296	24.8
51	Comcast Corp	418	1142	36.6	3GPP General Partnership Project Standards B	509	44.6	IEEE	418	36.6
52	LG Electronics Inc.	410	1494	27.4	3GPP General Partnership Project Standards B	615	41.2	IEEE	410	27.4
53	Palo Alto Networks	398	984	40.4	IEEE	398	40.4	ACM-Assoc Comput Mach	148	15.0
54	Assa Abloy AB	394	2040	19.3	IEEE	394	19.3	International Association for Cryptologic Research (IACR)	372	18.2
55	Ricoh Co. Ltd.	383	1001	38.3	IEEE	383	38.3	ACM-Assoc Comput Mach	232	23.2
56	NEC Corp	378	2012	18.8	3GPP General Partnership Project Standards B	585	29.1	IEEE	378	18.8
57	Sap SE	371	1490	24.9	ACM-Assoc Comput Mach	472	31.7	IEEE	371	24.9
58	Security First Corp	371	1350	27.5	ACM-Assoc Comput Mach	400	29.6	IEEE	371	27.5
59	DAMBALLA INC	370	1943	19.0	The USENIX Association	550	28.3	ACM-Assoc Comput Mach	373	19.2
60	Advanced New Technologies	366	629	58.2	IEEE	366	58.2	ACM-Assoc Comput Mach	45	7.2
61	Advanced Micro Devices Inc	360	1940	18.6	ACM-Assoc Comput Mach	970	50.0	Joint IEEE and ACM	373	19.2
62	VMWare Inc	352	1934	18.2	ACM-Assoc Comput Mach	716	37.0	The USENIX Association	363	18.8
63	Fujitsu Limited	338	1173	28.8	IEEE	338	28.8	ACM-Assoc Comput Mach	175	14.9
64	Duchossois Group Inc	330	960	34.4	IEEE	330	34.4	International Association for Cryptologic Research (IACR)	149	15.5
65	BLUERISC INC	329	904	36.4	IEEE	329	36.4	ACM-Assoc Comput Mach	206	22.8
66	Hewlett Packard Enterprises	317	1198	26.5	IEEE	317	26.5	Internet Soc/IETF-Internet Eng Task Force	230	19.2
67	Motorola Solutions Inc.	309	665	46.5	IEEE	309	46.5	Network Working Group RFC	68	10.2
68	Palantir Technologies Inc	301	1446	20.8	IEEE	301	20.8	ACM-Assoc Comput Mach	247	17.1
69	Toshiba Corp	299	1433	20.9	AACS-Advanced Access Content System	299	20.9	IEEE	299	20.9
70	BT Group PLC	298	765	39.0	IEEE	298	39.0	RELX Group (Elsevier)	67	8.8
71	Sonos Inc	295	762	38.7	IEEE	295	38.7	SPIE-Int Soc Opt Engineering	78	10.2
72	Silverbrook Pty Ltd	293	565	51.9	IEEE	293	51.9	RELX Group (Elsevier)	151	26.7
73	Analog Devices Inc.	292	676	43.2	IEEE	292	43.2	ACM-Assoc Comput Mach	147	21.7
74	Witricity Corp	288	532	54.1	IEEE	288	54.1	American Institute of Physics	36	6.8
75	Empire Technology Develop	283	1004	28.2	IEEE	283	28.2	ACM-Assoc Comput Mach	199	19.8
76	Rambus Inc.	275	1058	26.0	International Association for Cryptologic Rese	321	30.3	IEEE	275	26.0
77	BLACK HILLS MEDIA LLC	268	1619	16.6	Open Connectivity Foundation	924	57.1	IEEE	268	16.6
78	Meta Platforms Inc.(formerly	258	1143	22.6	ACM-Assoc Comput Mach	332	29.0	IEEE	258	22.6
79	T-Mobile USA INC	246	898	27.4	IEEE	246	27.4	ACM-Assoc Comput Mach	78	8.7
80	Panasonic Corporation	245	1009	24.3	IEEE	245	24.3	3GPP General Partnership Project Standards Body	169	16.7

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	VerintSys	244	1312	18.6	ACM-Assoc Comput Mach	276	21.0	IEEE	244	18.6
82	Accenture Ltd.	240	731	32.8	IEEE	240	32.8	ACM-Assoc Comput Mach	205	28.0
83	CONVERGENT MEDIA SO	240	1049	22.9	ACM-Assoc Comput Mach	257	24.5	IEEE	240	22.9
84	Commscope Holding (formerl	236	466	50.6	IEEE	236	50.6	3GPP General Partnership Project Standards Body	51	10.9
85	WEST VIEW RESEARCH L	235	572	41.1	IEEE	235	41.1	SAE-Society of Automobile Engineers	78	13.6
86	Walmart Stores Inc	234	640	36.6	IEEE	234	36.6	CBS Interactive	69	10.8
87	Open Text Corp	229	531	43.1	IEEE	229	43.1	ACM-Assoc Comput Mach	129	24.3
88	Intellectual Ventures Manage	223	1014	22.0	IEEE	223	22.0	ACM-Assoc Comput Mach	129	12.7
89	Quest Software Inc	221	564	39.2	IEEE	221	39.2	ACM-Assoc Comput Mach	100	17.7
90	Adobe Inc. (former Adobe Sy	217	550	39.5	IEEE	217	39.5	ACM-Assoc Comput Mach	92	16.7
91	Alibaba Group Holding Ltd	217	498	43.6	IEEE	217	43.6	ACM-Assoc Comput Mach	68	13.7
92	Western Digital Corp.	217	762	28.5	IEEE	217	28.5	ACM-Assoc Comput Mach	99	13.0
93	F5 Networks Inc	216	1367	15.8	Network Working Group RFC	263	19.2	ACM-Assoc Comput Mach	219	16.0
94	Bank of America Corp.	214	505	42.4	IEEE	214	42.4	ACM-Assoc Comput Mach	111	22.0
95	Global Tel Link Corp	210	400	52.5	IEEE	210	52.5	RELX Group (Elsevier)	27	6.8
96	HRL Laboratories LLC	206	946	21.8	ACM-Assoc Comput Mach	270	28.5	IEEE	206	21.8
97	Micro Focus International PL	206	678	30.4	IEEE	206	30.4	ACM-Assoc Comput Mach	90	13.3
98	JPMorgan	205	1175	17.4	IEEE	205	17.4	Source Media	119	10.1
99	Electronics and Telecommuni	204	438	46.6	IEEE	204	46.6	ACM-Assoc Comput Mach	40	9.1
100	NOK NOK LABS INC	202	979	20.6	IEEE	202	20.6	National Institute of Standards and Technology (NIST)	140	14.3

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<i>Diagnosis/Surgery/Medical Instruments</i>										
1	Medtronic Inc	11157	2E+05	6.5	RELX Group (Elsevier)	29677	17.2	Wolters Kluwer	23006	13.3
2	Boston Scientific Corp.	5949	86633	6.9	RELX Group (Elsevier)	22714	26.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	11074	12.8
3	Dexcom Inc	5666	98213	5.8	RELX Group (Elsevier)	25132	25.6	American Diabetes Association	10134	10.3
4	Johnson & Johnson	5262	76348	6.9	RELX Group (Elsevier)	17004	22.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	8022	10.5
5	Intuitive Surgical Inc.	4803	12437	38.6	IEEE	4803	38.6	The Medical Image Computing and Computer Assisted Interv	1108	8.9
6	Abbott Laboratories	4310	1E+05	4.3	RELX Group (Elsevier)	23709	23.7	ACS-Am Chem Soc	9821	9.8
7	Mass General Brigham (form	2566	42122	6.1	Optical Society of America	13133	31.2	RELX Group (Elsevier)	6455	15.3
8	Masimo Corp	2249	4696	47.9	IEEE	2249	47.9	RELX Group (Elsevier)	388	8.3
9	Koninklijke Philips N.V.	2068	16364	12.6	RELX Group (Elsevier)	2467	15.1	IEEE	2068	12.6
10	Intellectual Ventures Manage	1925	13866	13.9	IEEE	1925	13.9	RELX Group (Elsevier)	1584	11.4
11	Massachusetts Institute of Te	1860	8674	21.4	IEEE	1860	21.4	RELX Group (Elsevier)	1756	20.2
12	GUIDED THERAPY SYSTE	1522	6383	23.8	IEEE	1522	23.8	RELX Group (Elsevier)	1064	16.7
13	Stryker Corp.	1500	13951	10.8	RELX Group (Elsevier)	2510	18.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1671	12.0
14	Siemens Aktiengesellschaft	1419	8278	17.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1676	20.2	RELX Group (Elsevier)	1569	19.0
15	University of California	1330	11575	11.5	RELX Group (Elsevier)	2273	19.6	IEEE	1330	11.5
16	LivaNova Plc	1133	21340	5.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	4774	22.4	RELX Group (Elsevier)	4252	19.9
17	Smith & Nephew Plc.	1096	16512	6.6	RELX Group (Elsevier)	3286	19.9	Wolters Kluwer	1622	9.8
18	Vanderbilt University	1086	3296	32.9	IEEE	1086	32.9	RELX Group (Elsevier)	464	14.1
19	General Electric Company	967	4615	21.0	IEEE	967	21.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	677	14.7
20	Otto Bock Holding GmbH &	933	2806	33.3	IEEE	933	33.3	RELX Group (Elsevier)	588	21.0
21	Valencell Inc	900	2419	37.2	IEEE	900	37.2	RELX Group (Elsevier)	244	10.1
22	VIVAQUANT LLC	846	1714	49.4	IEEE	846	49.4	RELX Group (Elsevier)	206	12.0
23	Stanford University	813	23100	3.5	RELX Group (Elsevier)	3934	17.0	Springer Nature	3634	15.7
24	Columbia University	806	4982	16.2	RELX Group (Elsevier)	1281	25.7	IEEE	806	16.2
25	Mevion Medical Systems Inc	801	2563	31.3	IEEE	801	31.3	RELX Group (Elsevier)	497	19.4
26	Sotera Wireless	778	1657	47.0	IEEE	778	47.0	Springer Nature	330	19.9
27	Alphabet Inc.	746	2219	33.6	IEEE	746	33.6	RELX Group (Elsevier)	245	11.0
28	Ossur hf	732	2341	31.3	IEEE	732	31.3	RELX Group (Elsevier)	520	22.2
29	University of Illinois	698	10312	6.8	RELX Group (Elsevier)	1452	14.1	ACS-Am Chem Soc	1432	13.9
30	Baxter International Inc.	690	8576	8.0	RELX Group (Elsevier)	1929	22.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	911	10.6
31	University of Minnesota (The	651	3211	20.3	RELX Group (Elsevier)	672	20.9	IEEE	651	20.3
32	University of Nebraska	648	3297	19.7	IEEE	648	19.7	Springer Nature	557	16.9
33	BUTTERFLY NETWORKS I	587	675	87.0	IEEE	587	87.0	Acoustical Society of America	28	4.1
34	Maui Diagnostic Imaging	581	922	63.0	IEEE	581	63.0	RELX Group (Elsevier)	103	11.2
35	Cleveland Clinic (and Founda	534	3473	15.4	RELX Group (Elsevier)	728	21.0	IEEE	534	15.4
36	Johns Hopkins University	524	3516	14.9	RELX Group (Elsevier)	551	15.7	IEEE	524	14.9
37	University of Michigan	517	6215	8.3	RELX Group (Elsevier)	1746	28.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	573	9.2
38	MIRAMAR LABS INC	476	1353	35.2	IEEE	476	35.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	166	12.3
39	Virginia Tech University	462	3429	13.5	RELX Group (Elsevier)	760	22.2	IEEE	462	13.5

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	University of Texas	452	5849	7.7	RELX Group (Elsevier)	1181	20.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	656	11.2
41	FACENSE LTD	434	701	61.9	IEEE	434	61.9	RELX Group (Elsevier)	67	9.6
42	University of Washington	433	4546	9.5	RELX Group (Elsevier)	890	19.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	520	11.4
43	Becton Dickinson and Co.	423	27913	1.5	Wolters Kluwer	7920	28.4	RELX Group (Elsevier)	4669	16.7
44	The Arizona Board of Regent	405	1619	25.0	IEEE	405	25.0	RELX Group (Elsevier)	270	16.7
45	IWALK INC	385	1158	33.2	IEEE	385	33.2	RELX Group (Elsevier)	250	21.6
46	BIO CONTROL MEDICAL (383	1410	27.2	IEEE	383	27.2	Wolters Kluwer	222	15.7
47	Otsuka Holdings Co Ltd	382	2764	13.8	RELX Group (Elsevier)	536	19.4	IEEE	382	13.8
48	California Institute of Techno	370	2976	12.4	RELX Group (Elsevier)	429	14.4	IEEE	370	12.4
49	University of Pennsylvania	357	6451	5.5	RELX Group (Elsevier)	1038	16.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	830	12.9
50	University of Florida	348	1714	20.3	IEEE	348	20.3	RELX Group (Elsevier)	310	18.1
51	INDIVIDUAL PATENTER	347	8226	4.2	RELX Group (Elsevier)	1832	22.3	Wolters Kluwer	991	12.0
52	University Health Network	345	1121	30.8	IEEE	345	30.8	RELX Group (Elsevier)	195	17.4
53	Bonutti Technologies LLC	342	2071	16.5	Springer Nature	486	23.5	IEEE	342	16.5
54	HIGHLAND INSTRUMENT	338	721	46.9	IEEE	338	46.9	RELX Group (Elsevier)	84	11.7
55	Nevro Corp	337	4972	6.8	Wolters Kluwer	945	19.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	886	17.8
56	Samsung Electronics Co Ltd	323	790	40.9	IEEE	323	40.9	RELX Group (Elsevier)	83	10.5
57	Nyxoah SA	311	838	37.1	IEEE	311	37.1	RELX Group (Elsevier)	101	12.1
58	MIRADRY INC	308	836	36.8	IEEE	308	36.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	97	11.6
59	BIOSENSORS INTERNATI	305	1040	29.3	IEEE	305	29.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	152	14.6
60	Asahi Kasei Corp.	301	4419	6.8	Wolters Kluwer	1144	25.9	RELX Group (Elsevier)	795	18.0
61	Case Western Reserve Univer	301	1260	23.9	IEEE	301	23.9	RELX Group (Elsevier)	165	13.1
62	Conformis Inc	301	10112	3.0	Springer Nature	1686	16.7	RELX Group (Elsevier)	1275	12.6
63	Cirrus Logic Inc.	298	497	60.0	IEEE	298	60.0	Acoustical Society of America	74	14.9
64	AngioDynamics Inc.	293	3456	8.5	RELX Group (Elsevier)	776	22.5	Springer Nature	367	10.6
65	Alcon Inc	292	6451	4.5	RELX Group (Elsevier)	1768	27.4	American Medical Association	524	8.1
66	KONA MEDICAL INC	286	1948	14.7	RELX Group (Elsevier)	523	26.8	IEEE	286	14.7
67	University of Pittsburgh	286	3764	7.6	RELX Group (Elsevier)	1023	27.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	463	12.3
68	Medispectra Inc	278	741	37.5	IEEE	278	37.5	RELX Group (Elsevier)	82	11.1
69	Canon Inc	261	1571	16.6	IEEE	261	16.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	187	11.9
70	Saluda Medical Pty Ltd	257	1784	14.4	RELX Group (Elsevier)	299	16.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	262	14.7
71	BRAINGATE CO LLC	254	675	37.6	IEEE	254	37.6	RELX Group (Elsevier)	101	15.0
72	University of South Florida	254	1301	19.5	IEEE	254	19.5	RELX Group (Elsevier)	254	19.5
73	United States Department of	250	1379	18.1	RELX Group (Elsevier)	327	23.7	IEEE	250	18.1
74	Washington University in St.	236	4174	5.7	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	585	14.0	RELX Group (Elsevier)	574	13.8
75	BLUEWIND MEDICAL LT	229	520	44.0	IEEE	229	44.0	American Physiological Society	67	12.9
76	Duke University	228	2017	11.3	RELX Group (Elsevier)	283	14.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	259	12.8
77	International Business Machi	226	890	25.4	IEEE	226	25.4	RELX Group (Elsevier)	93	10.4
78	Victhom Human Bionics Inc	224	638	35.1	IEEE	224	35.1	RELX Group (Elsevier)	197	30.9
79	HEMOSONICS LLC	221	522	42.3	IEEE	221	42.3	RELX Group (Elsevier)	64	12.3
80	Medrobotics Corp	218	631	34.5	IEEE	218	34.5	Springer Nature	154	24.4

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Hologic Inc	217	3751	5.8	RELX Group (Elsevier)	840	22.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	638	17.0
82	PHYSIOWAVE INC	212	529	40.1	IEEE	212	40.1	Wolters Kluwer	109	20.6
83	University of North Carolina	211	1710	12.3	RELX Group (Elsevier)	315	18.4	IEEE	211	12.3
84	Zimmer Biomet Holdings	210	11070	1.9	RELX Group (Elsevier)	2287	20.7	Springer Nature	1484	13.4
85	Nuvasive Inc	205	8910	2.3	Wolters Kluwer	4476	50.2	RELX Group (Elsevier)	1121	12.6
86	University of Virginia (and P	202	1290	15.7	RELX Group (Elsevier)	230	17.8	IEEE	202	15.7
87	INNEROPTIC TECHNOLO	196	1194	16.4	IEEE	196	16.4	SPIE-Int Soc Opt Engineering	164	13.7
88	Align Technology Inc	194	1844	10.5	JCO - Journal of Clinical Orthodontics	263	14.3	RELX Group (Elsevier)	238	12.9
89	Bayer AG	194	2041	9.5	RELX Group (Elsevier)	322	15.8	Wolters Kluwer	289	14.2
90	Mayo Foundation for Medica	194	3517	5.5	RELX Group (Elsevier)	815	23.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	500	14.2
91	GEARBOX LLC	190	1380	13.8	IEEE	190	13.8	RELX Group (Elsevier)	153	11.1
92	Ecole Polytechnique Federale	185	1068	17.3	RELX Group (Elsevier)	187	17.5	IEEE	185	17.3
93	DISTALMOTION SA	179	272	65.8	IEEE	179	65.8	IEEE/RSJ	30	11.0
94	Hitachi Ltd	175	665	26.3	IEEE	175	26.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	77	11.6
95	Merz GmbH & Co KGaA	172	1180	14.6	RELX Group (Elsevier)	331	28.1	IEEE	172	14.6
96	Electrocor Llc	171	828	20.7	IEEE	171	20.7	Natl Acad Sciences	150	18.1
97	PULSE BIOSCIENCES INC	171	468	36.5	IEEE	171	36.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	74	15.8
98	ADVANCED BIO PROSTH	170	524	32.4	IEEE	170	32.4	RELX Group (Elsevier)	124	23.7
99	Georgia Institute of Technolo	169	1174	14.4	RELX Group (Elsevier)	215	18.3	IEEE	169	14.4
100	Impulse Dynamics N.V.	169	2535	6.7	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	525	20.7	Wolters Kluwer	360	14.2

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Information Storage</i>										
1	Micron Technology Inc.	15592	32198	48.4	IEEE	15592	48.4	RELX Group (Elsevier)	4951	15.4
2	Western Digital Corp.	6231	12057	51.7	IEEE	6231	51.7	American Institute of Physics	1278	10.6
3	ZENO SEMICONDUCTOR I	5800	7731	75.0	IEEE	5800	75.0	IEEE/JPN Soc App Phys	1267	16.4
4	International Business Machi	5068	16684	30.4	IEEE	5068	30.4	ACM-Assoc Comput Mach	2591	15.5
5	Macronix International Co. Lt	2536	4449	57.0	IEEE	2536	57.0	IEEE/JPN Soc App Phys	875	19.7
6	Broadcom Ltd	2475	3116	79.4	IEEE	2475	79.4	ACM-Assoc Comput Mach	138	4.4
7	ATTOPSEMI TECHNOLOG	2277	2831	80.4	IEEE	2277	80.4	IEEE/JPN Soc App Phys	345	12.2
8	Semiconductor Energy Labor	2275	25581	8.9	SID-Society for Information Display	8868	34.7	American Institute of Physics	3183	12.4
9	Conversant Intellectual Prope	2167	2637	82.2	IEEE	2167	82.2	IEEE/JPN Soc App Phys	196	7.4
10	Rambus Inc.	2135	3665	58.3	IEEE	2135	58.3	JEDEC Semiconductor Standards Organization	327	8.9
11	Seagate Technology Plc	1658	4839	34.3	IEEE	1658	34.3	American Institute of Physics	1020	21.1
12	Innovative Silicon SA	1580	1959	80.7	IEEE	1580	80.7	RELX Group (Elsevier)	84	4.3
13	Intel Corporation	1571	3939	39.9	IEEE	1571	39.9	Joint IEEE and ACM	709	18.0
14	Apple Inc	1459	3045	47.9	IEEE	1459	47.9	American Institute of Physics	252	8.3
15	Toshiba Corp	1432	3191	44.9	IEEE	1432	44.9	American Institute of Physics	411	12.9
16	Infineon Technologies AG	1320	1783	74.0	IEEE	1320	74.0	American Institute of Physics	109	6.1
17	Renesas Electronic Corporati	1155	1569	73.6	IEEE	1155	73.6	IEEE/JPN Soc App Phys	116	7.4
18	MONOLITHIC 3D INC	1023	1827	56.0	IEEE	1023	56.0	IEEE/JPN Soc App Phys	187	10.2
19	Hitachi Ltd	805	2153	37.4	IEEE	805	37.4	ACM-Assoc Comput Mach	192	8.9
20	Samsung Electronics Co Ltd	768	2220	34.6	IEEE	768	34.6	Joint IEEE and ACM	218	9.8
21	Microsoft Corporation	764	3824	20.0	ACM-Assoc Comput Mach	1398	36.6	IEEE	764	20.0
22	Oracle Corporation	759	2650	28.6	ACM-Assoc Comput Mach	1087	41.0	IEEE	759	28.6
23	TDK Corporation	715	2397	29.8	IEEE	715	29.8	American Institute of Physics	489	20.4
24	Netapp Inc	658	2971	22.1	ACM-Assoc Comput Mach	1222	41.1	IEEE	658	22.1
25	Commvault Systems Inc.	620	985	62.9	IEEE	620	62.9	ACM-Assoc Comput Mach	168	17.1
26	NXP Semiconductors NV	579	853	67.9	IEEE	579	67.9	Joint IEEE and ACM	84	9.8
27	Qualcomm Inc	576	971	59.3	IEEE	576	59.3	Joint IEEE and ACM	94	9.7
28	Texas Instruments Inc	540	827	65.3	IEEE	540	65.3	United Business Media/UBM Tech	67	8.1
29	Marvell Technology Group Lt	530	731	72.5	IEEE	530	72.5	ECMA International	34	4.7
30	Synopsys Inc.	516	988	52.2	IEEE	516	52.2	American Institute of Physics	134	13.6
31	Dell Technologies Inc	482	1346	35.8	IEEE	482	35.8	ACM-Assoc Comput Mach	342	25.4
32	Avid Technology Inc.	445	869	51.2	IEEE	445	51.2	ACM-Assoc Comput Mach	280	32.2
33	Softbank Corp	431	888	48.5	IEEE	431	48.5	Joint IEEE and ACM	184	20.7
34	Advanced Micro Devices Inc	428	1024	41.8	IEEE	428	41.8	Joint IEEE and ACM	237	23.1
35	HP Inc	420	1298	32.4	IEEE	420	32.4	ACM-Assoc Comput Mach	218	16.8
36	OVONYX MEMORY TECH	395	506	78.1	IEEE	395	78.1	IEEE/JPN Soc App Phys	30	5.9
37	Microchip Technology Inc.	392	508	77.2	IEEE	392	77.2	IEEE/JPN Soc App Phys	22	4.3
38	Intellectual Ventures Manage	378	693	54.5	IEEE	378	54.5	ACM-Assoc Comput Mach	53	7.6
39	Fujitsu Limited	367	695	52.8	IEEE	367	52.8	American Institute of Physics	66	9.5

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Taiwan Semiconductor Manu	350	503	69.6	IEEE	350	69.6	IEEE/JPN Soc App Phys	58	11.5
41	STMicroelectronics	334	532	62.8	IEEE	334	62.8	RELX Group (Elsevier)	38	7.1
42	Massachusetts Institute of Te	317	680	46.6	IEEE	317	46.6	American Institute of Physics	62	9.1
43	Sony Group Corp	317	872	36.4	IEEE	317	36.4	RELX Group (Elsevier)	67	7.7
44	Intertrust Technologies Corp	315	1947	16.2	ACM-Assoc Comput Mach	387	19.9	IEEE	315	16.2
45	Boston Scientific Corp.	298	395	75.4	IEEE	298	75.4	IEEE/JPN Soc App Phys	40	10.1
46	Alphabet Inc.	290	714	40.6	IEEE	290	40.6	ACM-Assoc Comput Mach	213	29.8
47	QST Holdings Llc	290	487	59.5	IEEE	290	59.5	Joint IEEE and ACM	56	11.5
48	NVIDIA Corp.	284	640	44.4	IEEE	284	44.4	Joint IEEE and ACM	149	23.3
49	Hewlett Packard Enterprises	277	803	34.5	IEEE	277	34.5	ACM-Assoc Comput Mach	221	27.5
50	Crossbar Inc	274	1065	25.7	IEEE	274	25.7	American Institute of Physics	145	13.6
51	Densbits Technologies Ltd	271	502	54.0	IEEE	271	54.0	Springer Nature	78	15.5
52	SK Hynix Inc	269	441	61.0	IEEE	269	61.0	Joint IEEE and ACM	38	8.6
53	Netlist Inc	267	1069	25.0	IP.Com	291	27.2	JEDEC Semiconductor Standards Organization	286	26.8
54	Nantero Inc	262	2508	10.4	ACS-Am Chem Soc	671	26.8	American Institute of Physics	527	21.0
55	Empire Technology Develop	241	507	47.5	IEEE	241	47.5	Joint IEEE and ACM	108	21.3
56	Panasonic Corporation	237	690	34.3	IEEE	237	34.3	Institute of Pure and Applied Physics	84	12.2
57	California Institute of Techno	229	344	66.6	IEEE	229	66.6	AAAS-Am Assoc Advancement Sci	18	5.2
58	Global Foundries Inc	229	438	52.3	IEEE	229	52.3	Joint IEEE and ACM	27	6.2
59	FireEye Inc	204	591	34.5	IEEE	204	34.5	ACM-Assoc Comput Mach	106	17.9
60	The Arizona Board of Regent	202	361	56.0	IEEE	202	56.0	Joint IEEE and ACM	30	8.3
61	Commissariat A L'Energie At	180	407	44.2	IEEE	180	44.2	American Institute of Physics	61	15.0
62	Mitsubishi Electric Corp	179	349	51.3	IEEE	179	51.3	ECMA International	77	22.1
63	Yonsei University	175	347	50.4	IEEE	175	50.4	Joint IEEE and ACM	61	17.6
64	NEC Corp	169	452	37.4	IEEE	169	37.4	American Institute of Physics	81	17.9
65	PACT XPP TECHNOLOGIE	158	275	57.5	IEEE	158	57.5	ACM-Assoc Comput Mach	24	8.7
66	Kandou	155	171	90.6	IEEE	155	90.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	8	4.7
67	Hon Hai Precision Industry C	149	362	41.2	IEEE	149	41.2	American Institute of Physics	57	15.7
68	Avalanche Technology Inc	144	653	22.1	American Institute of Physics	202	30.9	IEEE	144	22.1
69	Sap SE	138	510	27.1	IEEE	138	27.1	ACM-Assoc Comput Mach	100	19.6
70	OPTICAL DEVICES LLC	135	275	49.1	IEEE	135	49.1	RELX Group (Elsevier)	45	16.4
71	INDIVIDUAL PATENTER	134	267	50.2	IEEE	134	50.2	RELX Group (Elsevier)	26	9.7
72	Cisco Systems Inc.	127	274	46.4	IEEE	127	46.4	ACM-Assoc Comput Mach	72	26.3
73	Spin Memory	127	464	27.4	IEEE	127	27.4	American Institute of Physics	92	19.8
74	University of California	126	576	21.9	IEEE	126	21.9	ACS-Am Chem Soc	121	21.0
75	Industrial Technology Researc	122	220	55.5	IEEE	122	55.5	IEEE/JPN Soc App Phys	20	9.1
76	Kioxia Corp (formerly Toshiba	119	260	45.8	IEEE	119	45.8	IEEE/JPN Soc App Phys	41	15.8
77	Columbia University	116	313	37.1	IEEE	116	37.1	ACM-Assoc Comput Mach	53	16.9
78	Purdue University	116	240	48.3	IEEE	116	48.3	American Institute of Physics	21	8.8
79	Amazon.com Inc.	114	387	29.5	IEEE	114	29.5	ACM-Assoc Comput Mach	87	22.5
80	Tela Innovations inc	113	355	31.8	SPIE-Int Soc Opt Engineering	134	37.7	IEEE	113	31.8

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Soitec SA	111	140	79.3	IEEE	111	79.3	IET/IEE	7	5.0
82	PURE Storage Inc	109	689	15.8	Internet Soc/IETF-Internet Eng Task Force	321	46.6	ACM-Assoc Comput Mach	159	23.1
83	Round Rock Research LLC	109	480	22.7	RELX Group (Elsevier)	138	28.8	IEEE	109	22.7
84	United Microelectronics Corp	103	205	50.2	IEEE	103	50.2	American Institute of Physics	30	14.6
85	Huawei Technologies Compa	102	301	33.9	IEEE	102	33.9	Joint IEEE and ACM	67	22.3
86	Nokia Corporation	95	242	39.3	IEEE	95	39.3	ACM-Assoc Comput Mach	40	16.5
87	Ecole Polytechnique Federale	89	136	65.4	IEEE	89	65.4	Joint IEEE and ACM	13	9.6
88	Glassbridge Enterprises Inc	85	158	53.8	IEEE	85	53.8	Springer Nature	11	7.0
89	MEMRAY CORP	85	210	40.5	IEEE	85	40.5	Joint IEEE and ACM	55	26.2
90	Texas A&M University	84	105	80.0	IEEE	84	80.0	Science Press	5	4.8
91	Carnegie Mellon University	83	204	40.7	IEEE	83	40.7	American Institute of Physics	55	27.0
92	Waratek	83	220	37.7	IEEE	83	37.7	ACM-Assoc Comput Mach	55	25.0
93	R & D 3 LLC	79	79	100.0	IEEE	79	100.0			
94	VMWare Inc	75	388	19.3	ACM-Assoc Comput Mach	173	44.6	The USENIX Association	76	19.6
95	McAfee Inc	74	212	34.9	IEEE	74	34.9	ACM-Assoc Comput Mach	60	28.3
96	University of Minnesota (The	73	422	17.3	Springer Nature	100	23.7	American Physical Society	88	20.9
97	INSTON INC	72	233	30.9	IEEE	72	30.9	Springer Nature	48	20.6
98	Interuniversity MicroElectron	72	147	49.0	IEEE	72	49.0	Joint IEEE and ACM	20	13.6
99	University of Michigan	70	168	41.7	IEEE	70	41.7	Joint IEEE and ACM	42	25.0
100	Honeywell International Inc.	69	121	57.0	IEEE	69	57.0	Springer Nature	9	7.4

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>IOT/Internet of Things</i>										
1	Apple Inc	4378	12591	34.8	IEEE	4378	34.8	ACM-Assoc Comput Mach	2695	21.4
2	SolarEdge Technologies Inc	1501	1895	79.2	IEEE	1501	79.2	WIP-Renewable Energies	129	6.8
3	Velatia Group	839	1099	76.3	IEEE	839	76.3	Echelon Corp	81	7.4
4	SIPCO LLC	630	1097	57.4	IEEE	630	57.4	Internet Soc/IETF-Internet Eng Task Force	96	8.8
5	Cisco Systems Inc.	396	943	42.0	IEEE	396	42.0	ACM-Assoc Comput Mach	111	11.8
6	International Business Machi	369	914	40.4	IEEE	369	40.4	IP.Com	80	8.8
7	AT&T Inc	362	792	45.7	IEEE	362	45.7	RELX Group (Elsevier)	53	6.7
8	Honeywell International Inc.	325	476	68.3	IEEE	325	68.3	SAE-Society of Automobile Engineers	24	5.0
9	Comcast Corp	302	595	50.8	IEEE	302	50.8	3GPP General Partnership Project Standards Body	252	42.4
10	Rockwell Automation Inc	288	514	56.0	IEEE	288	56.0	ACM-Assoc Comput Mach	66	12.8
11	LG Electronics Inc.	284	565	50.3	IEEE	284	50.3	3GPP General Partnership Project Standards Body	205	36.3
12	Alphabet Inc.	263	604	43.5	IEEE	263	43.5	ACM-Assoc Comput Mach	105	17.4
13	Samsung Electronics Co Ltd	256	2848	9.0	3GPP General Partnership Project Standards B	2412	84.7	IEEE	256	9.0
14	ORIGIN WIRELESS INC	247	361	68.4	IEEE	247	68.4	American Physical Society	21	5.8
15	TRILLIANT NETWORKS IN	243	362	67.1	IEEE	243	67.1	Internet Soc/IETF-Internet Eng Task Force	24	6.6
16	General Electric Company	234	346	67.6	IEEE	234	67.6	RELX Group (Elsevier)	22	6.4
17	STRONG FORCE IOT PORT	231	296	78.0	IEEE	231	78.0	RELX Group (Elsevier)	28	9.5
18	Microsoft Corporation	226	577	39.2	IEEE	226	39.2	ACM-Assoc Comput Mach	108	18.7
19	Sonos Inc	196	456	43.0	IEEE	196	43.0	Network Working Group RFC	42	9.2
20	EAGLE HARBOR HOLDIN	175	490	35.7	IEEE	175	35.7	SAE-Society of Automobile Engineers	135	27.6
21	Schneider Electric S.A.	159	1368	11.6	ISA - Instrumentation, Systems & Automation	252	18.4	IEEE	159	11.6
22	Intel Corporation	155	365	42.5	IEEE	155	42.5	3GPP General Partnership Project Standards Body	111	30.4
23	ABB Ltd	146	175	83.4	IEEE	146	83.4	IET/IEE	5	2.9
24	California Institute of Techno	135	239	56.5	IEEE	135	56.5	RELX Group (Elsevier)	19	7.9
25	Walmart Stores Inc	124	341	36.4	IEEE	124	36.4	CBS Interactive	37	10.9
26	AMPT LLC	121	151	80.1	IEEE	121	80.1	RELX Group (Elsevier)	8	5.3
27	Qualcomm Inc	120	373	32.2	3GPP General Partnership Project Standards B	157	42.1	IEEE	120	32.2
28	Battelle Memorial Institute	114	158	72.2	IEEE	114	72.2	RELX Group (Elsevier)	8	5.1
29	Emerson Electric Co.	113	272	41.5	IEEE	113	41.5	RELX Group (Elsevier)	79	29.0
30	DOMINION ENERGY TEC	102	128	79.7	IEEE	102	79.7	International Telecommunication Union	12	9.4
31	ASTROLINK INTERNATIO	97	122	79.5	IEEE	97	79.5	International Telecommunication Union	12	9.8
32	EchoStar Corp	95	163	58.3	IEEE	95	58.3	CBS Interactive	24	14.7
33	Johnson Controls Internationa	93	206	45.1	IEEE	93	45.1	RELX Group (Elsevier)	37	18.0
34	Toyota Motor Corp	92	276	33.3	IEEE	92	33.3	ACM-Assoc Comput Mach	52	18.8
35	Siemens Aktiengesellschaft	85	156	54.5	IEEE	85	54.5	Internet Soc/IETF-Internet Eng Task Force	17	10.9
36	Nokia Corporation	80	259	30.9	IEEE	80	30.9	3GPP General Partnership Project Standards Body	66	25.5
37	STATSIGNAL SYSTEMS IN	75	132	56.8	IEEE	75	56.8	Internet Soc/IETF-Internet Eng Task Force	14	10.6
38	Extreme Networks Inc	74	157	47.1	IEEE	74	47.1	ACM-Assoc Comput Mach	20	12.7
39	Alstom	73	87	83.9	IEEE	73	83.9	IET/IEE	8	9.2

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Georgia Institute of Technolo	72	237	30.4	ACM-Assoc Comput Mach	120	50.6	IEEE	72	30.4
41	Adaptive Computing Enterpri	71	146	48.6	IEEE	71	48.6	ACM-Assoc Comput Mach	27	18.5
42	Dexcom Inc	70	432	16.2	RELX Group (Elsevier)	90	20.8	IEEE	70	16.2
43	BORGIA/CUMMINS LLC	69	102	67.6	IEEE	69	67.6	SPIE-Int Soc Opt Engineering	17	16.7
44	Itron Inc.	65	116	56.0	IEEE	65	56.0	ACM-Assoc Comput Mach	18	15.5
45	Zebra Technologies Corp.	65	102	63.7	IEEE	65	63.7	RFID Journal/YGS Group	11	10.8
46	NETWORK-1 TECHNOLOG	63	208	30.3	IEEE	63	30.3	Internet Soc/IETF-Internet Eng Task Force	53	25.5
47	Sap SE	62	188	33.0	IEEE	62	33.0	ACM-Assoc Comput Mach	41	21.8
48	University System of Maryla	62	64	96.9	IEEE	62	96.9	EPE Association	2	3.1
49	Amazon.com Inc.	58	219	26.5	IEEE	58	26.5	ACM-Assoc Comput Mach	43	19.6
50	Irobot Corp	56	99	56.6	IEEE	56	56.6	SPIE-Int Soc Opt Engineering	10	10.1
51	KIP PROD P1 LP	56	120	46.7	IEEE	56	46.7	American Society of Plant Biologists	18	15.0
52	Western Digital Corp.	56	68	82.4	IEEE	56	82.4	RELX Group (Elsevier)	12	17.6
53	State Farm Mutual Automobi	55	258	21.3	IEEE	55	21.3	IP.Com	27	10.5
54	UNIVERSITY OF SAO PAU	54	119	45.4	IEEE	54	45.4	National Institute of Standards and Technology (NIST)	18	15.1
55	PTC Inc	52	133	39.1	IEEE	52	39.1	ACM-Assoc Comput Mach	21	15.8
56	AFERO INC	51	70	72.9	IEEE	51	72.9	United Business Media/UBM Tech	11	15.7
57	Deere & Co.	51	83	61.4	IEEE	51	61.4	SPIE-Int Soc Opt Engineering	5	6.0
58	Hello Inc	51	67	76.1	IEEE	51	76.1	ACM-Assoc Comput Mach	16	23.9
59	SMART WIRES INC	51	73	69.9	IEEE	51	69.9	Research & Reviews	5	6.8
60	DELTA ENERGY & COMM	50	127	39.4	IEEE	50	39.4	RELX Group (Elsevier)	35	27.6
61	MAY PATENTS LTD	49	99	49.5	IEEE	49	49.5	SAE-Society of Automobile Engineers	20	20.2
62	Ericsson	47	483	9.7	3GPP General Partnership Project Standards B	212	43.9	Internet Soc/IETF-Internet Eng Task Force	105	21.7
63	Blackberry Ltd.	46	75	61.3	IEEE	46	61.3	ACM-Assoc Comput Mach	11	14.7
64	MIDDLE CHART LLC	46	61	75.4	IEEE	46	75.4	Multidisciplinary Digital Publishing Institute (MDPI)	15	24.6
65	University of Minnesota (The	45	52	86.5	IEEE	45	86.5	RELX Group (Elsevier)	3	5.8
66	Huawei Technologies Compa	44	330	13.3	3GPP General Partnership Project Standards B	154	46.7	Open Mobile Alliance (Standards Org)	60	18.2
67	TRIAX TECHNOLOGIES IN	44	76	57.9	IEEE	44	57.9	Hindawi Publishing Corporation	9	11.8
68	University of Texas	44	117	37.6	IEEE	44	37.6	RELX Group (Elsevier)	23	19.7
69	3M Co	43	65	66.2	IEEE	43	66.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	8	12.3
70	Dell Technologies Inc	42	112	37.5	IEEE	42	37.5	ACM-Assoc Comput Mach	18	16.1
71	Panasonic Corporation	42	69	60.9	IEEE	42	60.9	Network Working Group RFC	11	15.9
72	SECURENET SOLUTIONS	42	108	38.9	IEEE	42	38.9	ACM-Assoc Comput Mach	18	16.7
73	Aeris Communications Inc	41	58	70.7	IEEE	41	70.7	RELX Group (Elsevier)	10	17.2
74	FedEx Corp	40	223	17.9	RELX Group (Elsevier)	41	18.4	IEEE	40	17.9
75	Palo Alto Networks	40	68	58.8	IEEE	40	58.8	3GPP General Partnership Project Standards Body	17	25.0
76	SmartDrive Systems Inc	40	55	72.7	IEEE	40	72.7	ISIF/IEEE	4	7.3
77	Schweitzer Engineering Labo	39	44	88.6	IEEE	39	88.6	Multidisciplinary Digital Publishing Institute (MDPI)	2	4.5
78	Enphase Energy Inc	37	37	100.0	IEEE	37	100.0			
79	III HOLDINGS 12 LLC	37	74	50.0	IEEE	37	50.0	ACM-Assoc Comput Mach	11	14.9
80	Sunpower Corp	36	45	80.0	IEEE	36	80.0	EPE Association	4	8.9

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Boeing Co. (The)	35	63	55.6	IEEE	35	55.6	Springer Nature	4	6.3
82	Continental AG (Germany Fe	35	47	74.5	IEEE	35	74.5	RELX Group (Elsevier)	2	4.3
83	Convada Wireless LLC	35	567	6.2	3GPP General Partnership Project Standards B	244	43.0	Internet Soc/IETF-Internet Eng Task Force	116	20.5
84	Hubbell Inc.	35	44	79.5	IEEE	35	79.5	Multidisciplinary Digital Publishing Institute (MDPI)	3	6.8
85	THE FLORIDA INTERNATI	35	85	41.2	IEEE	35	41.2	ACM-Assoc Comput Mach	22	25.9
86	Witricity Corp	35	66	53.0	IEEE	35	53.0	American Institute of Physics	5	7.6
87	Accenture Ltd.	33	47	70.2	IEEE	33	70.2	A B B Corporate Management Services AG	4	8.5
88	Johnson & Johnson	33	61	54.1	IEEE	33	54.1	RELX Group (Elsevier)	10	16.4
89	Oracle Corporation	33	296	11.1	3GPP General Partnership Project Standards B	205	69.3	IEEE	33	11.1
90	University of California	33	922	3.6	ACS-Am Chem Soc	277	30.0	Royal Society of Chemistry	154	16.7
91	InterDigital Inc	32	332	9.6	3GPP General Partnership Project Standards B	170	51.2	European Telecom Standards Institute (ETSI)	57	17.2
92	Knowles Corp	32	50	64.0	IEEE	32	64.0	RELX Group (Elsevier)	4	8.0
93	Koninklijke Philips N.V.	32	170	18.8	IEEE	32	18.8	Springer Nature	25	14.7
94	LS Electric co. Ltd. (formerly	32	40	80.0	IEEE	32	80.0	IET/IEE	4	10.0
95	PELOTON TECHNOLOGY I	32	60	53.3	IEEE	32	53.3	American Automatic Control Council (AACC)	7	11.7
96	Tigo Energy Inc	32	48	66.7	IEEE	32	66.7	WIP-Renewable Energies	12	25.0
97	MACHINESENSE LLC	30	38	78.9	IEEE	30	78.9	Penton/IPC, Inc.	4	10.5
98	Abbott Laboratories	29	327	8.9	RELX Group (Elsevier)	42	12.8	Mary Ann Liebert Inc.	37	11.3
99	Massachusetts Institute of Te	29	66	43.9	IEEE	29	43.9	ACM-Assoc Comput Mach	6	9.1
100	Mitsubishi Electric Corp	29	54	53.7	IEEE	29	53.7	3GPP General Partnership Project Standards Body	18	33.3

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<i>Measuring, Testing and Control Devices</i>										
1	Thermo Fisher Scientific Inc	3459	19730	17.5	RELX Group (Elsevier)	6781	34.4	IEEE	3459	17.5
2	Siemens Aktiengesellschaft	3454	8326	41.5	IEEE	3454	41.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1843	22.1
3	Mass General Brigham (form	2949	47129	6.3	Optical Society of America	17359	36.8	RELX Group (Elsevier)	6463	13.7
4	Sanken Electric Co. Ltd.	2675	3497	76.5	IEEE	2675	76.5	RELX Group (Elsevier)	582	16.6
5	International Business Machi	2551	7480	34.1	IEEE	2551	34.1	RELX Group (Elsevier)	447	6.0
6	Irobot Corp	2212	4339	51.0	IEEE	2212	51.0	SPIE-Int Soc Opt Engineering	626	14.4
7	Honeywell International Inc.	2081	6846	30.4	IEEE	2081	30.4	RELX Group (Elsevier)	907	13.2
8	Microsoft Corporation	1893	5206	36.4	IEEE	1893	36.4	ACM-Assoc Comput Mach	1288	24.7
9	Texas Instruments Inc	1809	2205	82.0	IEEE	1809	82.0	Joint IEEE and ACM	72	3.3
10	FormFactor Inc	1767	3456	51.1	IEEE	1767	51.1	Springer Nature	642	18.6
11	General Electric Company	1443	7238	19.9	IEEE	1443	19.9	RELX Group (Elsevier)	1060	14.6
12	llumina Inc.	1058	4873	21.7	IEEE	1058	21.7	Royal Society of Chemistry	713	14.6
13	Alphabet Inc.	957	2588	37.0	IEEE	957	37.0	ACM-Assoc Comput Mach	365	14.1
14	Apple Inc	941	2227	42.3	IEEE	941	42.3	ACM-Assoc Comput Mach	275	12.3
15	Emerson Electric Co.	887	3834	23.1	IEEE	887	23.1	RELX Group (Elsevier)	556	14.5
16	Infineon Technologies AG	884	1406	62.9	IEEE	884	62.9	RELX Group (Elsevier)	118	8.4
17	California Institute of Techno	870	7582	11.5	RELX Group (Elsevier)	908	12.0	IEEE	870	11.5
18	SolarEdge Technologies Inc	833	1046	79.6	IEEE	833	79.6	WIP-Renewable Energies	88	8.4
19	Massachusetts Institute of Te	792	5311	14.9	IEEE	792	14.9	RELX Group (Elsevier)	677	12.7
20	Intel Corporation	749	1939	38.6	IEEE	749	38.6	3GPP General Partnership Project Standards Body	129	6.7
21	AT&T Inc	741	1703	43.5	IEEE	741	43.5	ACM-Assoc Comput Mach	95	5.6
22	ABB Ltd	724	1165	62.1	IEEE	724	62.1	RELX Group (Elsevier)	76	6.5
23	University of Minnesota (The	722	2462	29.3	IEEE	722	29.3	RELX Group (Elsevier)	303	12.3
24	NXP Semiconductors NV	713	1083	65.8	IEEE	713	65.8	RELX Group (Elsevier)	66	6.1
25	Qualcomm Inc	698	1538	45.4	IEEE	698	45.4	3GPP General Partnership Project Standards Body	260	16.9
26	Applied Materials Inc.	688	1476	46.6	IEEE	688	46.6	American Institute of Physics	136	9.2
27	Broadcom Ltd	662	1068	62.0	IEEE	662	62.0	RELX Group (Elsevier)	48	4.5
28	Lockheed Martin Corp.	651	9666	6.7	American Institute of Physics	1536	15.9	American Physical Society	1501	15.5
29	Boeing Co. (The)	633	2249	28.1	IEEE	633	28.1	RELX Group (Elsevier)	285	12.7
30	Schlumberger Ltd.	632	10330	6.1	Society of Exploration Geophysicists	2097	20.3	Society of Petroleum Engineers	1685	16.3
31	Intuitive Surgical Inc.	600	1597	37.6	IEEE	600	37.6	SAGES-Society of American Gastrointestinal and Endoscopic	176	11.0
32	Amazon.com Inc.	586	985	59.5	IEEE	586	59.5	SAGE Publications Ltd	53	5.4
33	Nokia Corporation	578	1582	36.5	IEEE	578	36.5	3GPP General Partnership Project Standards Body	115	7.3
34	University of Illinois	577	5984	9.6	American Institute of Physics	910	15.2	RELX Group (Elsevier)	880	14.7
35	Midtronics Inc.	576	1370	42.0	IEEE	576	42.0	RELX Group (Elsevier)	251	18.3
36	Commissariat A L'Energie At	567	2159	26.3	IEEE	567	26.3	RELX Group (Elsevier)	517	23.9
37	CPG TECHNOLOGIES LLC	548	1015	54.0	IEEE	548	54.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	113	11.1
38	STMicroelectronics	544	897	60.6	IEEE	544	60.6	RELX Group (Elsevier)	114	12.7
39	Synopsys Inc.	522	658	79.3	IEEE	522	79.3	Joint IEEE and ACM	44	6.7

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Analog Devices Inc.	513	762	67.3	IEEE	513	67.3	RELX Group (Elsevier)	46	6.0
41	INTOUCH HEALTH INC	510	1295	39.4	IEEE	510	39.4	Springer Nature	89	6.9
42	Honda Motor Co. Ltd.(Honda	502	1188	42.3	IEEE	502	42.3	RELX Group (Elsevier)	136	11.4
43	Raytheon Co.	490	1744	28.1	IEEE	490	28.1	SPIE-Int Soc Opt Engineering	156	8.9
44	Samsung Electronics Co Ltd	481	1314	36.6	IEEE	481	36.6	RELX Group (Elsevier)	128	9.7
45	Abbott Laboratories	473	15715	3.0	ACS-Am Chem Soc	3944	25.1	RELX Group (Elsevier)	3778	24.0
46	Duke University	467	2482	18.8	IEEE	467	18.8	RELX Group (Elsevier)	325	13.1
47	Schneider Electric S.A.	459	2839	16.2	IEEE	459	16.2	RELX Group (Elsevier)	333	11.7
48	INDIVIDUAL PATENTER	454	2507	18.1	Optical Society of America	626	25.0	IEEE	454	18.1
49	University of California	454	8218	5.5	RELX Group (Elsevier)	1225	14.9	ACS-Am Chem Soc	1189	14.5
50	STRONG FORCE IOT PORT	452	580	77.9	IEEE	452	77.9	RELX Group (Elsevier)	53	9.1
51	Industrial Technology Researc	440	1025	42.9	IEEE	440	42.9	RELX Group (Elsevier)	200	19.5
52	Battelle Memorial Institute	436	1808	24.1	RELX Group (Elsevier)	448	24.8	IEEE	436	24.1
53	Koninklijke Philips N.V.	436	3278	13.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	997	30.4	Society of Magnetic Resonance in Medicine (SMRM)	560	17.1
54	FARO Technologies Inc.	432	1298	33.3	IEEE	432	33.3	SPIE-Int Soc Opt Engineering	249	19.2
55	Toyota Motor Corp	430	1055	40.8	IEEE	430	40.8	ACM-Assoc Comput Mach	86	8.2
56	Rockwell Automation Inc	429	741	57.9	IEEE	429	57.9	RELX Group (Elsevier)	78	10.5
57	Advanced Micro Devices Inc	428	777	55.1	IEEE	428	55.1	SPIE-Int Soc Opt Engineering	64	8.2
58	Marvell Technology Group Lt	421	486	86.6	IEEE	421	86.6	Joint IEEE and ACM	12	2.5
59	HEMOSONICS LLC	418	1199	34.9	IEEE	418	34.9	RELX Group (Elsevier)	203	16.9
60	HRL Laboratories LLC	406	1000	40.6	IEEE	406	40.6	RELX Group (Elsevier)	108	10.8
61	University of Texas	405	2714	14.9	IEEE	405	14.9	RELX Group (Elsevier)	398	14.7
62	Advantest Corp.	402	563	71.4	IEEE	402	71.4	American Institute of Physics	26	4.6
63	Schweitzer Engineering Labo	394	461	85.5	IEEE	394	85.5	RELX Group (Elsevier)	27	5.9
64	OMNI MEDSCI INC	385	5060	7.6	Optical Society of America	1738	34.3	RELX Group (Elsevier)	795	15.7
65	Stanford University	364	4204	8.7	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	523	12.4	Optical Society of America	440	10.5
66	United States Navy	349	2090	16.7	IEEE	349	16.7	RELX Group (Elsevier)	290	13.9
67	Ericsson	348	898	38.8	IEEE	348	38.8	3GPP General Partnership Project Standards Body	203	22.6
68	TuSimple	343	445	77.1	IEEE	343	77.1	European Conference on Computer Vision-Google/Microsoft	28	6.3
69	Taiwan Semiconductor Manu	340	578	58.8	IEEE	340	58.8	American Institute of Physics	36	6.2
70	Teradyne Inc.	340	718	47.4	IEEE	340	47.4	ASME-Am Soc Mech Eng	103	14.3
71	ParkerVision Inc	332	531	62.5	IEEE	332	62.5	IET/IEE	50	9.4
72	Bosch (Robert) GmbH	321	1168	27.5	IEEE	321	27.5	RELX Group (Elsevier)	218	18.7
73	Micron Technology Inc.	307	553	55.5	IEEE	307	55.5	RELX Group (Elsevier)	41	7.4
74	Agilent Technologies Inc	302	1536	19.7	IEEE	302	19.7	RELX Group (Elsevier)	285	18.6
75	Cisco Systems Inc.	302	1340	22.5	Internet Soc/IETF-Internet Eng Task Force	410	30.6	IEEE	302	22.5
76	Brain Corporation	301	703	42.8	IEEE	301	42.8	MIT Press	70	10.0
77	Toshiba Corp	298	1069	27.9	IEEE	298	27.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	194	18.1
78	Intellectual Ventures Manage	297	1636	18.2	IEEE	297	18.2	RELX Group (Elsevier)	179	10.9
79	General Motors Corp	287	576	49.8	IEEE	287	49.8	RELX Group (Elsevier)	61	10.6
80	Johnson Controls Internationa	279	791	35.3	IEEE	279	35.3	RELX Group (Elsevier)	201	25.4

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	University of Southern Califo	279	854	32.7	IEEE	279	32.7	Optical Society of America	70	8.2
82	Georgia Institute of Technolo	277	986	28.1	IEEE	277	28.1	RELX Group (Elsevier)	121	12.3
83	NEC Corp	275	737	37.3	IEEE	275	37.3	IEICE-Inst Elec Info Comm Eng	35	4.7
84	TDK Corporation	273	567	48.1	IEEE	273	48.1	RELX Group (Elsevier)	113	19.9
85	HP Inc	272	1171	23.2	IEEE	272	23.2	ACS-Am Chem Soc	137	11.7
86	MACAU UNIVERSITY OF	270	314	86.0	IEEE	270	86.0	RELX Group (Elsevier)	18	5.7
87	Panasonic Corporation	270	964	28.0	IEEE	270	28.0	RELX Group (Elsevier)	213	22.1
88	University of Michigan	270	1706	15.8	IEEE	270	15.8	RELX Group (Elsevier)	237	13.9
89	Xerox Corp	270	1219	22.1	IEEE	270	22.1	RELX Group (Elsevier)	125	10.3
90	Hitachi Ltd	260	1429	18.2	IEEE	260	18.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	206	14.4
91	Fujitsu Limited	258	587	44.0	IEEE	258	44.0	RELX Group (Elsevier)	49	8.3
92	Halliburton Co. (Holding)	253	5115	4.9	Society of Petroleum Engineers	1600	31.3	SPWLA-Society of Petrophysicists and Well Log Analysts	649	12.7
93	Adaptix	252	374	67.4	IEEE	252	67.4	European Telecom Standards Institute (ETSI)	47	12.6
94	University of Pennsylvania	243	1246	19.5	IEEE	243	19.5	RELX Group (Elsevier)	170	13.6
95	Sony Group Corp	240	618	38.8	IEEE	240	38.8	RELX Group (Elsevier)	47	7.6
96	Purdue University	236	1952	12.1	RELX Group (Elsevier)	344	17.6	ACS-Am Chem Soc	335	17.2
97	University of Alabama	234	999	23.4	RELX Group (Elsevier)	293	29.3	IEEE	234	23.4
98	Canon Inc	232	2010	11.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	422	21.0	IEEE	232	11.5
99	Mitsubishi Electric Corp	232	510	45.5	IEEE	232	45.5	RELX Group (Elsevier)	46	9.0
100	Nintendo Co. Ltd.	230	837	27.5	IEEE	230	27.5	ACM-Assoc Comput Mach	169	20.2

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Optics/Photography/Electrophotography</i>										
1	Qualcomm Inc	1844	5235	35.2	IEEE	1844	35.2	SID-Society for Information Display	981	18.7
2	Infinera Corporation	1183	2204	53.7	IEEE	1183	53.7	IET/IEE	360	16.3
3	Mass General Brigham (form	863	13452	6.4	Optical Society of America	5095	37.9	RELX Group (Elsevier)	1892	14.1
4	IDC Llc	642	1779	36.1	IEEE	642	36.1	SID-Society for Information Display	236	13.3
5	Nikon Corp.	632	4314	14.6	SPIE-Int Soc Opt Engineering	1953	45.3	SEMATECH Consortium	849	19.7
6	Xperi Holding Corporation (F	620	1436	43.2	IEEE	620	43.2	SPIE-Int Soc Opt Engineering	200	13.9
7	Massachusetts Institute of Te	599	3860	15.5	Optical Society of America	625	16.2	IEEE	599	15.5
8	II-VI Inc	593	1729	34.3	IEEE	593	34.3	Optical Society of America	305	17.6
9	Corning Inc.	591	4449	13.3	Optical Society of America	961	21.6	IEEE	591	13.3
10	Alphabet Inc.	551	2108	26.1	IEEE	551	26.1	SID-Society for Information Display	329	15.6
11	Microsoft Corporation	550	1983	27.7	IEEE	550	27.7	ACM-Assoc Comput Mach	329	16.6
12	Synopsys Inc.	460	3089	14.9	SPIE-Int Soc Opt Engineering	1433	46.4	IEEE	460	14.9
13	The Arizona Board of Regent	447	3261	13.7	Optical Society of America	1055	32.4	SPIE-Int Soc Opt Engineering	465	14.3
14	NVIDIA Corp.	430	1247	34.5	IEEE	430	34.5	IET/IEE	236	18.9
15	YFY Inc	423	4952	8.5	SID-Society for Information Display	1993	40.2	National Symposium on Information Display	462	9.3
16	Hoya Corp	421	1264	33.3	IEEE	421	33.3	American Institute of Physics	259	20.5
17	Intellectual Ventures Manage	403	1724	23.4	IEEE	403	23.4	American Physical Society	231	13.4
18	Nokia Corporation	395	1756	22.5	IEEE	395	22.5	Optical Society of America	371	21.1
19	California Institute of Techno	376	4594	8.2	Optical Society of America	1582	34.4	Springer Nature	410	8.9
20	Magic Leap Inc	371	1767	21.0	IEEE	371	21.0	ACM-Assoc Comput Mach	236	13.4
21	Screen Holdings Co Ltd (For	356	1311	27.2	IEEE	356	27.2	RELX Group (Elsevier)	205	15.6
22	ASML Holding NV	346	10298	3.4	SPIE-Int Soc Opt Engineering	3765	36.6	American Institute of Physics	1761	17.1
23	International Business Machi	328	2038	16.1	SPIE-Int Soc Opt Engineering	435	21.3	IEEE	328	16.1
24	Intel Corporation	327	1088	30.1	IEEE	327	30.1	SPIE-Int Soc Opt Engineering	155	14.2
25	Ericsson	305	1351	22.6	Optical Society of America	528	39.1	IEEE	305	22.6
26	Cheetah Omni LLC	294	1153	25.5	IEEE	294	25.5	Optical Society of America	274	23.8
27	Stanford University	248	1877	13.2	Optical Society of America	339	18.1	IEEE	248	13.2
28	University of California	233	2061	11.3	Optical Society of America	303	14.7	Springer Nature	276	13.4
29	Cisco Systems Inc.	232	571	40.6	IEEE	232	40.6	Optical Society of America	151	26.4
30	Texas Instruments Inc	228	827	27.6	IEEE	228	27.6	American Institute of Physics	138	16.7
31	Adobe Inc. (former Adobe Sy	219	512	42.8	IEEE	219	42.8	ACM-Assoc Comput Mach	127	24.8
32	ALENTIC MICROSCIENCE	211	732	28.8	IEEE	211	28.8	Royal Society of Chemistry	101	13.8
33	Lockheed Martin Corp.	207	1164	17.8	Optical Society of America	292	25.1	IEEE	207	17.8
34	Samsung Electronics Co Ltd	207	1630	12.7	Optical Society of America	236	14.5	IEEE	207	12.7
35	3M Co	198	3714	5.3	Optical Society of America	536	14.4	RELX Group (Elsevier)	402	10.8
36	University of Colorado (The	191	2204	8.7	Optical Society of America	845	38.3	RELX Group (Elsevier)	247	11.2
37	Micron Technology Inc.	190	1933	9.8	American Institute of Physics	352	18.2	SPIE-Int Soc Opt Engineering	267	13.8
38	HP Inc	183	899	20.4	IEEE	183	20.4	Optical Society of America	97	10.8
39	Princeton University	171	385	44.4	IEEE	171	44.4	American Physical Society	34	8.8

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Canon Inc	170	2002	8.5	SPIE-Int Soc Opt Engineering	249	12.4	American Institute of Physics	225	11.2
41	Honeywell International Inc.	168	808	20.8	IEEE	168	20.8	Optical Society of America	144	17.8
42	Fujitsu Limited	166	758	21.9	IEEE	166	21.9	Optical Society of America	115	15.2
43	Viavi Solutions Inc	164	801	20.5	IEEE	164	20.5	Optical Society of America	149	18.6
44	Prismian SPA	163	981	16.6	Optical Society of America	215	21.9	IEEE	163	16.6
45	United States of America Dep	156	636	24.5	IEEE	156	24.5	IET/IEE	129	20.3
46	Electronics and Telecommuni	155	434	35.7	IEEE	155	35.7	Optical Society of America	72	16.6
47	Huawei Technologies Compa	141	365	38.6	IEEE	141	38.6	Optical Society of America	108	29.6
48	University of Texas	138	1206	11.4	American Institute of Physics	191	15.8	Optical Society of America	187	15.5
49	CIRREX SYSTEMS LLC	136	597	22.8	IEEE	136	22.8	Optical Society of America	86	14.4
50	AUGMENTED VISION INC	134	1062	12.6	Optical Society of America	363	34.2	SPIE-Int Soc Opt Engineering	157	14.8
51	OmniGuide Inc	134	1030	13.0	Optical Society of America	242	23.5	IEEE	134	13.0
52	Emcore Corp.	133	168	79.2	IEEE	133	79.2	IEEE/OSA	11	6.5
53	VASCULAR IMAGING CO	133	281	47.3	IEEE	133	47.3	IET/IEE	80	28.5
54	Georgia Institute of Technolo	128	384	33.3	IEEE	128	33.3	Optical Society of America	52	13.5
55	MONOLITHIC 3D INC	128	224	57.1	IEEE	128	57.1	IEEE/JPN Soc App Phys	21	9.4
56	Cubic Wafer Inc	126	224	56.3	IEEE	126	56.3	SPIE-Int Soc Opt Engineering	42	18.8
57	Ostendo Technologies Inc	116	461	25.2	IEEE	116	25.2	ACM-Assoc Comput Mach	77	16.7
58	Xerox Corp	112	1131	9.9	ACS-Am Chem Soc	239	21.1	RELX Group (Elsevier)	138	12.2
59	DIGILENS INC	110	3712	3.0	Optical Society of America	773	20.8	SPIE-Int Soc Opt Engineering	616	16.6
60	Furukawa Electric Co. Ltd.	109	828	13.2	Optical Society of America	271	32.7	IEEE	109	13.2
61	Raytheon Co.	108	1531	7.1	Optical Society of America	422	27.6	SPIE-Int Soc Opt Engineering	308	20.1
62	Sumitomo Electric Industries	105	1025	10.2	Optical Society of America	269	26.2	European Conference on Optical Communication (ECOC) Soc	148	14.4
63	PTS Corporation	102	232	44.0	IEEE	102	44.0	Optical Society of America	34	14.7
64	Calient Technologies Inc.	101	200	50.5	IEEE	101	50.5	Optical Society of America	29	14.5
65	Nippon Telegraph & Telepho	100	578	17.3	Optical Society of America	104	18.0	IEEE	100	17.3
66	Global Foundries Inc	97	519	18.7	Optical Society of America	169	32.6	IEEE	97	18.7
67	Skorpios Technologies Inc	97	214	45.3	IEEE	97	45.3	Optical Society of America	75	35.0
68	Industrial Technology Researc	90	404	22.3	IEEE	90	22.3	SPIE-Int Soc Opt Engineering	66	16.3
69	Neophotonics Corporation	90	241	37.3	IEEE	90	37.3	Optical Society of America	36	14.9
70	Lumentum Holdings Inc	89	434	20.5	Optical Society of America	114	26.3	IEEE	89	20.5
71	Applied Materials Inc.	88	525	16.8	SPIE-Int Soc Opt Engineering	139	26.5	IEEE	88	16.8
72	NXP Semiconductors NV	87	274	31.8	IEEE	87	31.8	American Institute of Physics	45	16.4
73	RPX Corp	87	209	41.6	IEEE	87	41.6	IEEE/OSA	28	13.4
74	Broadcom Ltd	86	276	31.2	IEEE	86	31.2	SPIE-Int Soc Opt Engineering	53	19.2
75	STMicroelectronics	86	245	35.1	IEEE	86	35.1	SPIE-Int Soc Opt Engineering	42	17.1
76	OMM INC	85	194	43.8	IEEE	85	43.8	SPIE-Int Soc Opt Engineering	43	22.2
77	Apple Inc	84	683	12.3	Optical Society of America	186	27.2	SPIE-Int Soc Opt Engineering	104	15.2
78	Columbia University	83	804	10.3	Springer Nature	127	15.8	ACS-Am Chem Soc	113	14.1
79	Mitsubishi Electric Corp	83	223	37.2	IEEE	83	37.2	ACM-Assoc Comput Mach	38	17.0
80	Carl-Zeiss Stiftung	81	2941	2.8	SPIE-Int Soc Opt Engineering	1102	37.5	Optical Society of America	567	19.3

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Commscope Holding (formerl	81	911	8.9	Optical Society of America	179	19.6	IEEE/OSA	163	17.9
82	Juniper Networks Inc.	81	166	48.8	IEEE	81	48.8	Optical Society of America	48	28.9
83	Oracle Corporation	81	170	47.6	IEEE	81	47.6	Optical Society of America	40	23.5
84	Eastman Kodak Company	78	1048	7.4	RELX Group (Elsevier)	156	14.9	ACS-Am Chem Soc	139	13.3
85	Motorola Solutions Inc.	76	305	24.9	American Institute of Physics	90	29.5	IEEE	76	24.9
86	Oewaves Inc	76	253	30.0	Optical Society of America	100	39.5	IEEE	76	30.0
87	Hewlett Packard Enterprises	75	207	36.2	IEEE	75	36.2	Optical Society of America	57	27.5
88	HRL Laboratories LLC	75	318	23.6	IEEE	75	23.6	American Institute of Physics	51	16.0
89	Seiko Epson Corporation	74	294	25.2	IEEE	74	25.2	SID-Society for Information Display	58	19.7
90	University of Washington	73	649	11.2	SPIE-Int Soc Opt Engineering	97	14.9	Optical Society of America	85	13.1
91	Extreme Networks Inc	72	166	43.4	IEEE	72	43.4	ACM-Assoc Comput Mach	22	13.3
92	Panasonic Corporation	72	545	13.2	SPIE-Int Soc Opt Engineering	91	16.7	Optical Society of America	73	13.4
93	Fujikura Ltd.	67	667	10.0	Optical Society of America	191	28.6	IEICE-Inst Elec Info Comm Eng	124	18.6
94	Hong Kong University of Sci	66	144	45.8	IEEE	66	45.8	RELX Group (Elsevier)	11	7.6
95	NEC Corp	66	404	16.3	IEEE	66	16.3	Optical Society of America	42	10.4
96	University of Illinois	65	465	14.0	American Institute of Physics	112	24.1	Optical Society of America	84	18.1
97	Cornell University	63	571	11.0	Optical Society of America	84	14.7	RELX Group (Elsevier)	69	12.1
98	INDIVIDUAL PATENTER	63	422	14.9	Optical Society of America	132	31.3	IEEE	63	14.9
99	Johnson & Johnson	63	1985	3.2	Optical Society of America	347	17.5	RELX Group (Elsevier)	335	16.9
100	OMNI MEDSCI INC	63	970	6.5	Optical Society of America	340	35.1	RELX Group (Elsevier)	155	16.0

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Power Systems</i>										
1	SolarEdge Technologies Inc	5691	7135	79.8	IEEE	5691	79.8	WIP-Renewable Energies	555	7.8
2	Witricity Corp	4426	8439	52.4	IEEE	4426	52.4	American Institute of Physics	699	8.3
3	CPG TECHNOLOGIES LLC	2703	5031	53.7	IEEE	2703	53.7	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	538	10.7
4	ABB Ltd	1694	2473	68.5	IEEE	1694	68.5	IVI Foundation/SCPI Consortium	94	3.8
5	Flex Ltd (Formerly Flextronic	1663	1802	92.3	IEEE	1663	92.3	United Business Media/UBM Tech	79	4.4
6	Energous Corporation	1633	2122	77.0	IEEE	1633	77.0	The European Association on Antennas and Propagation (Eur	171	8.1
7	Cirrus Logic Inc.	1614	1772	91.1	IEEE	1614	91.1	ISO-International Standards Organization	50	2.8
8	Massachusetts Institute of Te	1448	3995	36.2	IEEE	1448	36.2	RELX Group (Elsevier)	540	13.5
9	Rockwell Automation Inc	1357	1500	90.5	IEEE	1357	90.5	EPE Association	40	2.7
10	Enphase Energy Inc	1285	1419	90.6	IEEE	1285	90.6	IET/IEE	44	3.1
11	General Electric Company	1279	3264	39.2	IEEE	1279	39.2	US Dept of Energy	778	23.8
12	AMPT LLC	928	1198	77.5	IEEE	928	77.5	RELX Group (Elsevier)	79	6.6
13	Analog Devices Inc.	887	1381	64.2	IEEE	887	64.2	RELX Group (Elsevier)	267	19.3
14	SYNQOR INC	886	1013	87.5	IEEE	886	87.5	Penton/IPC, Inc.	45	4.4
15	Texas Instruments Inc	863	1025	84.2	IEEE	863	84.2	RELX Group (Elsevier)	39	3.8
16	Renesas Electronic Corporati	846	997	84.9	IEEE	846	84.9	IEEE/JPN Soc App Phys	20	2.0
17	Infineon Technologies AG	758	874	86.7	IEEE	758	86.7	EPE Association	16	1.8
18	MOJO MOBILITY INC	721	943	76.5	IEEE	721	76.5	RELX Group (Elsevier)	78	8.3
19	Murata Manufacturing Co. Lt	688	838	82.1	IEEE	688	82.1	RELX Group (Elsevier)	38	4.5
20	Vicor Corp	662	845	78.3	IEEE	662	78.3	Center for Power Electronics Systems (Virginia Tech)	41	4.9
21	Intel Corporation	562	676	83.1	IEEE	562	83.1	Joint IEEE and ACM	16	2.4
22	Sunpower Corp	557	609	91.5	IEEE	557	91.5	IET/IEE	18	3.0
23	Qualcomm Inc	480	613	78.3	IEEE	480	78.3	RELX Group (Elsevier)	38	6.2
24	NXP Semiconductors NV	466	564	82.6	IEEE	466	82.6	IET/IEE	15	2.7
25	STMicroelectronics	464	591	78.5	IEEE	464	78.5	RELX Group (Elsevier)	29	4.9
26	Qorvo	435	490	88.8	IEEE	435	88.8	European Microwave Association	16	3.3
27	International Business Machi	411	902	45.6	IEEE	411	45.6	RELX Group (Elsevier)	102	11.3
28	Industrial Technology Researc	387	807	48.0	IEEE	387	48.0	RELX Group (Elsevier)	210	26.0
29	Raytheon Co.	345	1169	29.5	IEEE	345	29.5	NASA-National Aeronautics and Space Admin	123	10.5
30	NUCURRENT INC	340	427	79.6	IEEE	340	79.6	Wireless Power Consortium	23	5.4
31	Alstom	320	418	76.6	IEEE	320	76.6	IET/IEE	24	5.7
32	Tigo Energy Inc	319	498	64.1	IEEE	319	64.1	WIP-Renewable Energies	134	26.9
33	Irobot Corp	317	596	53.2	IEEE	317	53.2	SPIE-Int Soc Opt Engineering	92	15.4
34	Battelle Memorial Institute	303	2245	13.5	RELX Group (Elsevier)	509	22.7	ACS-Am Chem Soc	395	17.6
35	California Institute of Techno	286	3325	8.6	RELX Group (Elsevier)	988	29.7	ACS-Am Chem Soc	488	14.7
36	THE FLORIDA INTERNATI	282	309	91.3	IEEE	282	91.3	IET/IEE	8	2.6
37	Siemens Aktiengesellschaft	281	439	64.0	IEEE	281	64.0	RELX Group (Elsevier)	40	9.1
38	University of California	280	2306	12.1	ACS-Am Chem Soc	482	20.9	RELX Group (Elsevier)	418	18.1
39	Power Integrations Inc.	273	413	66.1	IEEE	273	66.1	Penton/IPC, Inc.	58	14.0

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Apple Inc	270	1023	26.4	IEEE	270	26.4	RELX Group (Elsevier)	176	17.2
41	University of Illinois	247	1074	23.0	RELX Group (Elsevier)	377	35.1	IEEE	247	23.0
42	Schneider Electric S.A.	237	307	77.2	IEEE	237	77.2	IEEE/DOE/JPL	9	2.9
43	Eaton Corp.	234	333	70.3	IEEE	234	70.3	RELX Group (Elsevier)	35	10.5
44	Broadcom Ltd	223	282	79.1	IEEE	223	79.1	American Institute of Physics	10	3.5
45	Koch Industries Inc	223	282	79.1	IEEE	223	79.1	RELX Group (Elsevier)	13	4.6
46	Delta Electronics Inc	208	236	88.1	IEEE	208	88.1	Korean Institute of Power Electronics	13	5.5
47	Microchip Technology Inc.	205	247	83.0	IEEE	205	83.0	IEICE-Inst Elec Info Comm Eng	9	3.6
48	Samsung Electronics Co Ltd	205	1739	11.8	RELX Group (Elsevier)	486	27.9	ACS-Am Chem Soc	283	16.3
49	Hong Kong University of Sci	193	295	65.4	IEEE	193	65.4	RELX Group (Elsevier)	34	11.5
50	The Arizona Board of Regent	193	1161	16.6	ACS-Am Chem Soc	259	22.3	RELX Group (Elsevier)	242	20.8
51	Powvermat Technologies Ltd	191	197	97.0	IEEE	191	97.0	American Institute of Physics	5	2.5
52	Toshiba Corp	189	845	22.4	RELX Group (Elsevier)	316	37.4	IEEE	189	22.4
53	Huawei Technologies Compa	188	219	85.8	IEEE	188	85.8	Audio Eng Soc	3	1.4
54	Honeywell International Inc.	187	591	31.6	IEEE	187	31.6	RELX Group (Elsevier)	163	27.6
55	Semiconductor Energy Labor	183	3905	4.7	SID-Society for Information Display	933	23.9	RELX Group (Elsevier)	471	12.1
56	On Semiconductor Corporati	181	218	83.0	IEEE	181	83.0	Penton/IPC, Inc.	8	3.7
57	Boeing Co. (The)	174	501	34.7	IEEE	174	34.7	RELX Group (Elsevier)	81	16.2
58	Microsoft Corporation	172	461	37.3	IEEE	172	37.3	ACM-Assoc Comput Mach	93	20.2
59	Midtronics Inc.	166	425	39.1	IEEE	166	39.1	RELX Group (Elsevier)	73	17.2
60	Marvell Technology Group Lt	165	199	82.9	IEEE	165	82.9	Texas Instruments	16	8.0
61	R2 SEMICONDUCTOR INC	163	166	98.2	IEEE	163	98.2	European Microwave Association	2	1.2
62	Tesla Motors Inc	162	209	77.5	IEEE	162	77.5	WIP-Renewable Energies	11	5.3
63	AT&T Inc	159	327	48.6	IEEE	159	48.6	RELX Group (Elsevier)	17	5.2
64	Koninklijke Philips N.V.	158	285	55.4	IEEE	158	55.4	Wireless Power Consortium	19	6.7
65	University of Wisconsin	158	221	71.5	IEEE	158	71.5	RELX Group (Elsevier)	11	5.0
66	Utah State University	158	227	69.6	IEEE	158	69.6	ACS-Am Chem Soc	12	5.3
67	General Motors Corp	154	1131	13.6	RELX Group (Elsevier)	353	31.2	IEEE	154	13.6
68	Mitsubishi Electric Corp	149	211	70.6	IEEE	149	70.6	IET/IEE	26	12.3
69	Micron Technology Inc.	148	217	68.2	IEEE	148	68.2	RELX Group (Elsevier)	14	6.5
70	University of Alabama	148	175	84.6	IEEE	148	84.6	IET/IEE	8	4.6
71	O2Micro International Ltd.	147	224	65.6	IEEE	147	65.6	Texas Instruments	30	13.4
72	Silicon Laboratories Inc	145	163	89.0	IEEE	145	89.0	SAE-Society of Automobile Engineers	12	7.4
73	Advanced Energy Industries I	140	152	92.1	IEEE	140	92.1	Texas Instruments	3	2.0
74	Alphabet Inc.	137	215	63.7	IEEE	137	63.7	ACM-Assoc Comput Mach	12	5.6
75	University of Minnesota (The	136	230	59.1	IEEE	136	59.1	American Institute of Physics	19	8.3
76	Vertiv Corp	136	153	88.9	IEEE	136	88.9	China Academic Journal Electronic Publishing House	4	2.6
77	Western Digital Corp.	134	164	81.7	IEEE	134	81.7	McGraw Hill	16	9.8
78	INFINITE POWER SOLUTI	130	1398	9.3	RELX Group (Elsevier)	317	22.7	American Institute of Physics	309	22.1
79	Hitachi Ltd	128	325	39.4	IEEE	128	39.4	IET/IEE	47	14.5
80	Schweitzer Engineering Labo	125	130	96.2	IEEE	125	96.2	IET/IEE	3	2.3

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81	SRI International	124	705	17.6	SPIE-Int Soc Opt Engineering	152	21.6	IEEE	124	17.6
82	University of Washington	123	788	15.6	RELX Group (Elsevier)	244	31.0	IEEE	123	15.6
83	Causam Energy Inc	121	228	53.1	IEEE	121	53.1	Springer Nature	47	20.6
84	Panasonic Corporation	120	1275	9.4	RELX Group (Elsevier)	389	30.5	Electrochemical Society, Inc.	306	24.0
85	Conversant Intellectual Prope	118	143	82.5	IEEE	118	82.5	Joint IEEE and ACM	12	8.4
86	FYRE STORM INC	118	124	95.2	IEEE	118	95.2	Scripta Pub Co.	3	2.4
87	Commissariat A L'Energie At	117	696	16.8	RELX Group (Elsevier)	277	39.8	IEEE	117	16.8
88	University of Hong Kong	116	133	87.2	IEEE	116	87.2	IET/IEE	7	5.3
89	University of Texas	116	967	12.0	RELX Group (Elsevier)	241	24.9	Electrochemical Society, Inc.	130	13.4
90	TDK Corporation	114	302	37.7	IEEE	114	37.7	RELX Group (Elsevier)	63	20.9
91	University of Florida	113	319	35.4	IEEE	113	35.4	RELX Group (Elsevier)	54	16.9
92	MOTOR EXCELLENCE LL	111	125	88.8	IEEE	111	88.8	IEEE/ASME	14	11.2
93	Virginia Tech University	111	121	91.7	IEEE	111	91.7	Korean Institute of Power Electronics	2	1.7
94	Bosch (Robert) GmbH	109	1089	10.0	RELX Group (Elsevier)	259	23.8	Electrochemical Society, Inc.	229	21.0
95	SMART WIRES INC	109	151	72.2	IEEE	109	72.2	ACM-Assoc Comput Mach	9	6.0
96	University of Colorado (The	108	180	60.0	IEEE	108	60.0	RELX Group (Elsevier)	15	8.3
97	University of Michigan	107	448	23.9	IEEE	107	23.9	RELX Group (Elsevier)	83	18.5
98	Intellectual Ventures Manage	106	244	43.4	IEEE	106	43.4	RELX Group (Elsevier)	39	16.0
99	NEC Corp	105	275	38.2	IEEE	105	38.2	RELX Group (Elsevier)	60	21.8
100	Lenovo Group Ltd	103	136	75.7	IEEE	103	75.7	RELX Group (Elsevier)	12	8.8

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Robotics and Intelligent Manufacturing</i>										
1	Intuitive Surgical Inc.	6294	14994	42.0	IEEE	6294	42.0	The Medical Image Computing and Computer Assisted Interv	1552	10.4
2	Irobot Corp	5999	11151	53.8	IEEE	5999	53.8	SPIE-Int Soc Opt Engineering	1551	13.9
3	Applied Materials Inc.	1607	2726	59.0	IEEE	1607	59.0	American Institute of Physics	155	5.7
4	INTOUCH HEALTH INC	1524	3890	39.2	IEEE	1524	39.2	Springer Nature	248	6.4
5	Alphabet Inc.	952	1855	51.3	IEEE	952	51.3	ACM-Assoc Comput Mach	126	6.8
6	Brain Corporation	835	2131	39.2	IEEE	835	39.2	MIT Press	237	11.1
7	Vanderbilt University	752	1237	60.8	IEEE	752	60.8	RELX Group (Elsevier)	87	7.0
8	Massachusetts Institute of Te	704	1981	35.5	IEEE	704	35.5	RELX Group (Elsevier)	326	16.5
9	Microsoft Corporation	683	1892	36.1	IEEE	683	36.1	ACM-Assoc Comput Mach	377	19.9
10	Honda Motor Co. Ltd.(Honda	671	1599	42.0	IEEE	671	42.0	RELX Group (Elsevier)	204	12.8
11	Stryker Corp.	660	2072	31.9	IEEE	660	31.9	Springer Nature	323	15.6
12	University of Nebraska	644	2995	21.5	IEEE	644	21.5	Springer Nature	515	17.2
13	International Business Machi	571	1747	32.7	IEEE	571	32.7	ACM-Assoc Comput Mach	201	11.5
14	Johnson & Johnson	522	3736	14.0	RELX Group (Elsevier)	898	24.0	IEEE	522	14.0
15	Siemens Aktiengesellschaft	416	931	44.7	IEEE	416	44.7	RELX Group (Elsevier)	88	9.5
16	Sony Group Corp	398	566	70.3	IEEE	398	70.3	IEEE/RSJ	45	8.0
17	Amazon.com Inc.	393	647	60.7	IEEE	393	60.7	International Foundation of Robotics Research	38	5.9
18	PDF Solutions	393	596	65.9	IEEE	393	65.9	SPIE-Int Soc Opt Engineering	134	22.5
19	HRL Laboratories LLC	289	591	48.9	IEEE	289	48.9	RELX Group (Elsevier)	57	9.6
20	Samsung Electronics Co Ltd	286	445	64.3	IEEE	286	64.3	IEEE/RSJ	33	7.4
21	MACAU UNIVERSITY OF	267	291	91.8	IEEE	267	91.8	Springer Nature	5	1.7
22	TELADOC HEALTH INC	262	670	39.1	IEEE	262	39.1	Springer Nature	48	7.2
23	Otto Bock Holding GmbH &	260	781	33.3	IEEE	260	33.3	RELX Group (Elsevier)	162	20.7
24	Walmart Stores Inc	254	713	35.6	IEEE	254	35.6	CBS Interactive	80	11.2
25	Medrobotics Corp	243	704	34.5	IEEE	243	34.5	Springer Nature	173	24.6
26	SIPCO LLC	238	414	57.5	IEEE	238	57.5	Internet Soc/IETF-Internet Eng Task Force	35	8.5
27	Immersion Corp.	234	601	38.9	IEEE	234	38.9	ASME-Am Soc Mech Eng	50	8.3
28	Boeing Co. (The)	229	607	37.7	IEEE	229	37.7	RELX Group (Elsevier)	101	16.6
29	Johns Hopkins University	228	500	45.6	IEEE	228	45.6	RELX Group (Elsevier)	38	7.6
30	General Electric Company	216	436	49.5	IEEE	216	49.5	RELX Group (Elsevier)	46	10.6
31	Advanced Micro Devices Inc	197	417	47.2	IEEE	197	47.2	RELX Group (Elsevier)	51	12.2
32	Emerson Electric Co.	197	775	25.4	IEEE	197	25.4	RELX Group (Elsevier)	138	17.8
33	Cadence Design Systems Inc	194	458	42.4	IEEE	194	42.4	Joint IEEE and ACM	158	34.5
34	Koch Industries Inc	184	238	77.3	IEEE	184	77.3	RELX Group (Elsevier)	13	5.5
35	Cimpress NV	179	435	41.1	IEEE	179	41.1	RELX Group (Elsevier)	121	27.8
36	Honeywell International Inc.	172	424	40.6	IEEE	172	40.6	RELX Group (Elsevier)	78	18.4
37	SRI International	169	390	43.3	IEEE	169	43.3	SPIE-Int Soc Opt Engineering	56	14.4
38	ABB Ltd	168	266	63.2	IEEE	168	63.2	RELX Group (Elsevier)	30	11.3
39	The Arizona Board of Regent	163	409	39.9	IEEE	163	39.9	RELX Group (Elsevier)	57	13.9

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	L3 Harris Technologies (form	156	236	66.1	IEEE	156	66.1	Society of Petroleum Engineers	16	6.8
41	Bonutti Technologies LLC	155	719	21.6	Springer Nature	199	27.7	IEEE	155	21.6
42	INDIVIDUAL PATENTER	151	320	47.2	IEEE	151	47.2	ACM-Assoc Comput Mach	11	3.4
43	ICOSYSTEM CORP	150	198	75.8	IEEE	150	75.8	IET/IEE	10	5.1
44	University of Pennsylvania	144	259	55.6	IEEE	144	55.6	Springer Nature	18	6.9
45	Battelle Memorial Institute	140	263	53.2	IEEE	140	53.2	IEEE/RSJ	28	10.6
46	University of Southern Califo	140	228	61.4	IEEE	140	61.4	Springer Nature	18	7.9
47	NEURALA INC	139	276	50.4	IEEE	139	50.4	MIT Press	25	9.1
48	Rockwell Automation Inc	135	255	52.9	IEEE	135	52.9	RELX Group (Elsevier)	30	11.8
49	Align Technology Inc	134	1178	11.4	JCO - Journal of Clinical Orthodontics	205	17.4	SAGE Publications Ltd	147	12.5
50	IWALK INC	132	393	33.6	IEEE	132	33.6	RELX Group (Elsevier)	81	20.6
51	Harvard University	130	550	23.6	IEEE	130	23.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	77	14.0
52	University of Washington	125	297	42.1	IEEE	125	42.1	RELX Group (Elsevier)	22	7.4
53	Walt Disney Co.	125	343	36.4	IEEE	125	36.4	ACM-Assoc Comput Mach	106	30.9
54	MONOLITHIC 3D INC	124	223	55.6	IEEE	124	55.6	IEEE/JPN Soc App Phys	24	10.8
55	ROY-G-BIV CORP	123	385	31.9	IEEE	123	31.9	ISO-International Standards Organization	67	17.4
56	Broadcom Ltd	120	205	58.5	IEEE	120	58.5	RELX Group (Elsevier)	38	18.5
57	Taiwan Semiconductor Manu	118	216	54.6	IEEE	118	54.6	SPIE-Int Soc Opt Engineering	18	8.3
58	University of Minnesota (The	116	210	55.2	IEEE	116	55.2	Springer Nature	16	7.6
59	Canon Inc	115	258	44.6	IEEE	115	44.6	RELX Group (Elsevier)	23	8.9
60	Toyota Motor Corp	115	263	43.7	IEEE	115	43.7	ACM-Assoc Comput Mach	21	8.0
61	Fanuc Ltd.	113	218	51.8	IEEE	113	51.8	RELX Group (Elsevier)	30	13.8
62	Xerox Corp	111	290	38.3	IEEE	111	38.3	ACM-Assoc Comput Mach	37	12.8
63	Ecole Polytechnique Federale	110	370	29.7	IEEE	110	29.7	Springer Nature	51	13.8
64	University of South Florida	110	222	49.5	IEEE	110	49.5	RELX Group (Elsevier)	16	7.2
65	SPHERO INC	108	110	98.2	IEEE	108	98.2	American Automatic Control Council (AACC)	2	1.8
66	University of California	108	241	44.8	IEEE	108	44.8	RELX Group (Elsevier)	26	10.8
67	Toshiba Corp	107	171	62.6	IEEE	107	62.6	RELX Group (Elsevier)	6	3.5
68	Tela Innovations inc	106	273	38.8	IEEE	106	38.8	SPIE-Int Soc Opt Engineering	96	35.2
69	Teradyne Inc.	105	268	39.2	IEEE	105	39.2	ASME-Am Soc Mech Eng	36	13.4
70	Intellectual Ventures Manage	99	509	19.4	IEEE	99	19.4	RELX Group (Elsevier)	59	11.6
71	Johnson Controls Internationa	99	256	38.7	IEEE	99	38.7	RELX Group (Elsevier)	61	23.8
72	VIRTUAL INCISION CORP	98	456	21.5	IEEE	98	21.5	Springer Nature	74	16.2
73	Tokyo Electron Limited	97	242	40.1	IEEE	97	40.1	RELX Group (Elsevier)	26	10.7
74	American Express Co.	96	343	28.0	IEEE	96	28.0	The USENIX Association	39	11.4
75	Intel Corporation	90	153	58.8	IEEE	90	58.8	ACM-Assoc Comput Mach	14	9.2
76	Sap SE	89	303	29.4	IEEE	89	29.4	RELX Group (Elsevier)	53	17.5
77	Raytheon Co.	87	257	33.9	IEEE	87	33.9	RELX Group (Elsevier)	31	12.1
78	Caterpillar Inc.	86	229	37.6	IEEE	86	37.6	SAE-Society of Automobile Engineers	35	15.3
79	Panasonic Corporation	86	181	47.5	IEEE	86	47.5	RSJ-Robotics Society of Japan	12	6.6
80	NVIDIA Corp.	84	116	72.4	IEEE	84	72.4	European Conference on Computer Vision-Google/Microsoft	9	7.8

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	3D Systems Corp.	82	179	45.8	IEEE	82	45.8	ACM-Assoc Comput Mach	40	22.3
82	ALOFT MEDIA LLC	82	103	79.6	IEEE	82	79.6	ASCE-AMER SOC CIVIL ENGINEERS	6	5.8
83	ARCHI CON DES INVENTI	82	408	20.1	ACM-Assoc Comput Mach	115	28.2	IEEE	82	20.1
84	Midea Group Co Ltd	82	120	68.3	IEEE	82	68.3	IEEE/RSJ	12	10.0
85	OneTrust	82	273	30.0	ACM-Assoc Comput Mach	145	53.1	IEEE	82	30.0
86	Procter & Gamble Co.	81	137	59.1	IEEE	81	59.1	RELX Group (Elsevier)	14	10.2
87	Hyundai Motor Co.	78	169	46.2	IEEE	78	46.2	IEEE/RSJ	24	14.2
88	Lockheed Martin Corp.	78	218	35.8	IEEE	78	35.8	RELX Group (Elsevier)	16	7.3
89	Rag Foundation	78	127	61.4	IEEE	78	61.4	RELX Group (Elsevier)	18	14.2
90	HP Inc	75	180	41.7	IEEE	75	41.7	ACM-Assoc Comput Mach	25	13.9
91	University of Michigan	74	190	38.9	IEEE	74	38.9	RELX Group (Elsevier)	28	14.7
92	Lincoln Electric Holdings Inc	73	195	37.4	IEEE	73	37.4	Amer Welding Soc	25	12.8
93	HURCO COMPANIES INC	72	168	42.9	IEEE	72	42.9	Springer Nature	19	11.3
94	General Motors Corp	71	180	39.4	IEEE	71	39.4	RELX Group (Elsevier)	20	11.1
95	Health Discovery Corp	70	282	24.8	IEEE	70	24.8	IWDM Org	24	8.5
96	BERKSHIRE GREY INC	69	104	66.3	IEEE	69	66.3	ASME-Am Soc Mech Eng	25	24.0
97	Deere & Co.	69	139	49.6	IEEE	69	49.6	RELX Group (Elsevier)	14	10.1
98	Fujitsu Limited	69	141	48.9	IEEE	69	48.9	RELX Group (Elsevier)	14	9.9
99	AUREON LABORATORIES	67	273	24.5	IEEE	67	24.5	RELX Group (Elsevier)	35	12.8
100	MKS Instruments Inc.	67	170	39.4	IEEE	67	39.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	27	15.9

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<i>Semiconductors/Solid-State Devices/Electronics</i>										
1	Micron Technology Inc.	22565	84202	26.8	IEEE	22565	26.8	RELX Group (Elsevier)	15809	18.8
2	MONOLITHIC 3D INC	16424	29218	56.2	IEEE	16424	56.2	IEEE/JPN Soc App Phys	2980	10.2
3	Semiconductor Energy Labor	12583	2E+05	6.8	SID-Society for Information Display	60973	33.0	American Institute of Physics	26612	14.4
4	International Business Machi	10229	24855	41.2	IEEE	10229	41.2	American Institute of Physics	3622	14.6
5	Taiwan Semiconductor Manu	8308	26383	31.5	IEEE	8308	31.5	American Institute of Physics	7668	29.1
6	Qorvo	5358	7043	76.1	IEEE	5358	76.1	American Institute of Physics	410	5.8
7	Tela Innovations inc	5162	16917	30.5	SPIE-Int Soc Opt Engineering	6200	36.6	IEEE	5162	30.5
8	Macronix International Co. Lt	4768	9113	52.3	IEEE	4768	52.3	IEEE/JPN Soc App Phys	1786	19.6
9	Intel Corporation	4543	9224	49.3	IEEE	4543	49.3	American Institute of Physics	1177	12.8
10	Wolfspeed Inc. (formerly Cre	4331	12040	36.0	IEEE	4331	36.0	American Institute of Physics	2595	21.6
11	Western Digital Corp.	4299	8740	49.2	IEEE	4299	49.2	American Institute of Physics	1079	12.3
12	Infineon Technologies AG	3770	7180	52.5	IEEE	3770	52.5	American Institute of Physics	891	12.4
13	Murata Manufacturing Co. Lt	3076	4070	75.6	IEEE	3076	75.6	RELX Group (Elsevier)	150	3.7
14	Chipbond Technology Corp	2885	3612	79.9	IEEE	2885	79.9	RELX Group (Elsevier)	266	7.4
15	On Semiconductor Corporati	2708	3762	72.0	IEEE	2708	72.0	RELX Group (Elsevier)	292	7.8
16	NXP Semiconductors NV	2556	5147	49.7	IEEE	2556	49.7	American Institute of Physics	809	15.7
17	University of Illinois	2419	25356	9.5	American Institute of Physics	5133	20.2	ACS-Am Chem Soc	4082	16.1
18	Applied Materials Inc.	2349	13114	17.9	American Institute of Physics	2754	21.0	IEEE	2349	17.9
19	ASM International N.V.	2341	23845	9.8	American Institute of Physics	4306	18.1	RELX Group (Elsevier)	4293	18.0
20	Amberwave Inc	2337	6843	34.2	IEEE	2337	34.2	American Institute of Physics	2045	29.9
21	PDF Solutions	2288	3617	63.3	IEEE	2288	63.3	SPIE-Int Soc Opt Engineering	842	23.3
22	Broadcom Ltd	2055	6079	33.8	IEEE	2055	33.8	SMTA-Surface Mount Technology Association	1017	16.7
23	Toshiba Corp	2013	5174	38.9	IEEE	2013	38.9	American Institute of Physics	840	16.2
24	Texas Instruments Inc	2011	3515	57.2	IEEE	2011	57.2	American Institute of Physics	340	9.7
25	Global Foundries Inc	1824	3656	49.9	IEEE	1824	49.9	American Institute of Physics	477	13.0
26	Xperi Holding Corporation (F	1751	5518	31.7	IEEE	1751	31.7	American Institute of Physics	993	18.0
27	Samsung Electronics Co Ltd	1524	11059	13.8	American Institute of Physics	2107	19.1	ACS-Am Chem Soc	1802	16.3
28	Renesas Electronic Corporati	1497	2629	56.9	IEEE	1497	56.9	IEEE/JPN Soc App Phys	306	11.6
29	ZENO SEMICONDUCTOR I	1456	1909	76.3	IEEE	1456	76.3	IEEE/JPN Soc App Phys	274	14.4
30	Advanced Micro Devices Inc	1364	2379	57.3	IEEE	1364	57.3	American Institute of Physics	230	9.7
31	University of California	1352	16819	8.0	American Institute of Physics	3764	22.4	RELX Group (Elsevier)	2215	13.2
32	STMicroelectronics	1349	3228	41.8	IEEE	1349	41.8	RELX Group (Elsevier)	500	15.5
33	Qualcomm Inc	1329	2694	49.3	IEEE	1329	49.3	American Institute of Physics	225	8.4
34	California Institute of Techno	1276	8646	14.8	RELX Group (Elsevier)	1324	15.3	IEEE	1276	14.8
35	Transphorm Inc	1203	2561	47.0	IEEE	1203	47.0	American Institute of Physics	453	17.7
36	II-VI Inc	1177	3455	34.1	IEEE	1177	34.1	American Institute of Physics	635	18.4
37	Analog Devices Inc.	1126	1600	70.4	IEEE	1126	70.4	RELX Group (Elsevier)	92	5.8
38	HRL Laboratories LLC	1112	2395	46.4	IEEE	1112	46.4	American Institute of Physics	415	17.3
39	Massachusetts Institute of Te	1066	7775	13.7	American Institute of Physics	1617	20.8	IEEE	1066	13.7

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40	Commissariat A L'Energie At	1064	5521	19.3	American Institute of Physics	1221	22.1	IEEE	1064	19.3
41	United Microelectronics Corp	960	2039	47.1	IEEE	960	47.1	American Institute of Physics	285	14.0
42	Fujitsu Limited	901	2448	36.8	IEEE	901	36.8	American Institute of Physics	309	12.6
43	Panasonic Corporation	853	4225	20.2	IEEE	853	20.2	American Institute of Physics	731	17.3
44	Synopsys Inc.	838	1846	45.4	IEEE	838	45.4	American Institute of Physics	333	18.0
45	Motorola Solutions Inc.	824	2756	29.9	IEEE	824	29.9	American Institute of Physics	747	27.1
46	Crossbar Inc	738	2849	25.9	IEEE	738	25.9	RELX Group (Elsevier)	389	13.7
47	Lam Research Corp.	730	5155	14.2	American Institute of Physics	1255	24.3	IEEE	730	14.2
48	Mevion Medical Systems Inc	726	2262	32.1	IEEE	726	32.1	RELX Group (Elsevier)	436	19.3
49	Apple Inc	682	1791	38.1	IEEE	682	38.1	American Institute of Physics	239	13.3
50	Unisantis Electronics Ltd	632	774	81.7	IEEE	632	81.7	Institute of Pure and Applied Physics	50	6.5
51	Hon Hai Precision Industry C	571	3371	16.9	American Institute of Physics	783	23.2	IEEE	571	16.9
52	Soraa Inc	557	7248	7.7	American Institute of Physics	2107	29.1	Institute of Pure and Applied Physics	1478	20.4
53	Michigan State University	552	7008	7.9	Optical Society of America	1527	21.8	American Institute of Physics	1087	15.5
54	Mitsubishi Electric Corp	545	1137	47.9	IEEE	545	47.9	American Institute of Physics	101	8.9
55	Thermo Fisher Scientific Inc	536	2800	19.1	RELX Group (Elsevier)	885	31.6	IEEE	536	19.1
56	Hong Kong University of Sci	524	1068	49.1	IEEE	524	49.1	American Institute of Physics	212	19.9
57	Hitachi Ltd	523	1792	29.2	IEEE	523	29.2	American Institute of Physics	361	20.1
58	Industrial Technology Researc	522	1677	31.1	IEEE	522	31.1	RELX Group (Elsevier)	296	17.7
59	AMS AG	518	3692	14.0	American Institute of Physics	931	25.2	IEEE	518	14.0
60	Interuniversity MicroElectron	518	1766	29.3	IEEE	518	29.3	American Institute of Physics	297	16.8
61	Cubic Corporation	499	693	72.0	IEEE	499	72.0	The International Society of Infrared, Millimeter, and Terahert	42	6.1
62	Nantero Inc	483	7550	6.4	ACS-Am Chem Soc	2278	30.2	American Institute of Physics	1578	20.9
63	Aisin Corporation (Aisin Seki	481	3385	14.2	Optical Society of America	1229	36.3	IEEE	481	14.2
64	Innovative Silicon SA	453	556	81.5	IEEE	453	81.5	RELX Group (Elsevier)	24	4.3
65	Power Integrations Inc.	450	695	64.7	IEEE	450	64.7	American Institute of Physics	62	8.9
66	Sulvolta Inc	448	930	48.2	IEEE	448	48.2	American Institute of Physics	139	14.9
67	Mass General Brigham (form	440	6817	6.5	Optical Society of America	2545	37.3	RELX Group (Elsevier)	943	13.8
68	SolAero Technologies Corp	427	839	50.9	IEEE	427	50.9	RELX Group (Elsevier)	132	15.7
69	United States Navy	425	2435	17.5	American Institute of Physics	605	24.8	IEEE	425	17.5
70	General Electric Company	424	1522	27.9	IEEE	424	27.9	American Institute of Physics	238	15.6
71	Electronics and Telecommuni	400	1158	34.5	IEEE	400	34.5	American Institute of Physics	230	19.9
72	NEC Corp	381	1194	31.9	IEEE	381	31.9	American Institute of Physics	220	18.4
73	Georgia Institute of Technolo	379	1121	33.8	IEEE	379	33.8	RELX Group (Elsevier)	148	13.2
74	SK Hynix Inc	378	816	46.3	IEEE	378	46.3	American Institute of Physics	114	14.0
75	ACORN TECHNOLOGIES I	377	1781	21.2	American Institute of Physics	525	29.5	IEEE	377	21.2
76	University of Wisconsin	374	1840	20.3	American Institute of Physics	490	26.6	IEEE	374	20.3
77	Soitec SA	369	1963	18.8	American Institute of Physics	523	26.6	IEEE	369	18.8
78	Xtera Communications Inc.	368	1101	33.4	IEEE	368	33.4	Optical Society of America	263	23.9
79	Jiangsu ChangJiang Electroni	366	484	75.6	IEEE	366	75.6	International Microelectronics And Packaging Society	51	10.5
80	Sanken Electric Co. Ltd.	365	550	66.4	IEEE	365	66.4	RELX Group (Elsevier)	76	13.8

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81	SiOnyx Inc	363	2276	15.9	American Institute of Physics	637	28.0	RELX Group (Elsevier)	363	15.9
82	Sony Group Corp	359	1809	19.8	American Institute of Physics	363	20.1	IEEE	359	19.8
83	Silicon Genesis Corporation	356	1514	23.5	IEEE	356	23.5	American Institute of Physics	292	19.3
84	Lockheed Martin Corp.	347	2037	17.0	American Institute of Physics	380	18.7	IEEE	347	17.0
85	The Arizona Board of Regent	347	4112	8.4	American Institute of Physics	738	17.9	RELX Group (Elsevier)	693	16.9
86	TDK Corporation	343	1746	19.6	American Institute of Physics	457	26.2	IEEE	343	19.6
87	Xerox Corp	342	2025	16.9	American Institute of Physics	553	27.3	IEEE	342	16.9
88	Sunpower Corp	341	627	54.4	IEEE	341	54.4	RELX Group (Elsevier)	73	11.6
89	Raytheon Co.	339	1502	22.6	IEEE	339	22.6	American Institute of Physics	224	14.9
90	Seoul Semiconductor Co Ltd	339	3128	10.8	American Institute of Physics	1182	37.8	RELX Group (Elsevier)	432	13.8
91	ARTILUX INC	334	658	50.8	IEEE	334	50.8	Optical Society of America	111	16.9
92	Honeywell International Inc.	334	2724	12.3	ACS-Am Chem Soc	479	17.6	RELX Group (Elsevier)	337	12.4
93	Vishay Intertechnology Inc.	329	515	63.9	IEEE	329	63.9	RELX Group (Elsevier)	31	6.0
94	Bosch (Robert) GmbH	325	577	56.3	IEEE	325	56.3	RELX Group (Elsevier)	96	16.6
95	Sanan Optoelectronics Techn	323	1466	22.0	American Institute of Physics	566	38.6	US Dept of Energy	392	26.7
96	Columbia University	322	4226	7.6	American Institute of Physics	1511	35.8	MRS-Materials Research Soc	448	10.6
97	Microchip Technology Inc.	322	515	62.5	IEEE	322	62.5	IEEE/JPN Soc App Phys	32	6.2
98	ACORN SEMI LLC	318	2038	15.6	American Institute of Physics	729	35.8	RELX Group (Elsevier)	372	18.3
99	Viavi Solutions Inc	311	769	40.4	IEEE	311	40.4	American Institute of Physics	155	20.2
100	University of Michigan	310	2026	15.3	American Institute of Physics	446	22.0	IEEE	310	15.3

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<i>Smart Grid/Smart Meters/Energy Infrastructure</i>										
1	SolarEdge Technologies Inc	1501	1895	79.2	IEEE	1501	79.2	WIP-Renewable Energies	129	6.8
2	Velatia Group	839	1099	76.3	IEEE	839	76.3	Echelon Corp	81	7.4
3	Honeywell International Inc.	234	284	82.4	IEEE	234	82.4	American Library Association	12	4.2
4	TRILLIANT NETWORKS IN	231	343	67.3	IEEE	231	67.3	Internet Soc/IETF-Internet Eng Task Force	23	6.7
5	SIPCO LLC	157	271	57.9	IEEE	157	57.9	Internet Soc/IETF-Internet Eng Task Force	27	10.0
6	General Electric Company	150	229	65.5	IEEE	150	65.5	RELX Group (Elsevier)	21	9.2
7	California Institute of Techno	135	239	56.5	IEEE	135	56.5	RELX Group (Elsevier)	19	7.9
8	ABB Ltd	131	156	84.0	IEEE	131	84.0	IET/IEE	5	3.2
9	AMPT LLC	121	151	80.1	IEEE	121	80.1	RELX Group (Elsevier)	8	5.3
10	Battelle Memorial Institute	114	157	72.6	IEEE	114	72.6	RELX Group (Elsevier)	8	5.1
11	International Business Machi	104	187	55.6	IEEE	104	55.6	IP.Com	17	9.1
12	DOMINION ENERGY TEC	102	128	79.7	IEEE	102	79.7	International Telecommunication Union	12	9.4
13	ASTROLINK INTERNATIO	97	122	79.5	IEEE	97	79.5	International Telecommunication Union	12	9.8
14	Alstom	73	87	83.9	IEEE	73	83.9	IET/IEE	8	9.2
15	University System of Maryla	62	64	96.9	IEEE	62	96.9	EPE Association	2	3.1
16	Itron Inc.	59	104	56.7	IEEE	59	56.7	ACM-Assoc Comput Mach	18	17.3
17	SMART WIRES INC	51	73	69.9	IEEE	51	69.9	Research & Reviews	5	6.8
18	University of Minnesota (The	45	52	86.5	IEEE	45	86.5	RELX Group (Elsevier)	3	5.8
19	Qualcomm Inc	44	75	58.7	IEEE	44	58.7	3GPP General Partnership Project Standards Body	10	13.3
20	University of Texas	44	117	37.6	IEEE	44	37.6	RELX Group (Elsevier)	23	19.7
21	3M Co	43	54	79.6	IEEE	43	79.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	5	9.3
22	DELTA ENERGY & COMM	39	98	39.8	IEEE	39	39.8	RELX Group (Elsevier)	27	27.6
23	Enphase Energy Inc	37	37	100.0	IEEE	37	100.0			
24	Sunpower Corp	36	45	80.0	IEEE	36	80.0	EPE Association	4	8.9
25	Hubbell Inc.	35	43	81.4	IEEE	35	81.4	Multidisciplinary Digital Publishing Institute (MDPI)	3	7.0
26	Witricity Corp	35	66	53.0	IEEE	35	53.0	American Institute of Physics	5	7.6
27	Siemens Aktiengesellschaft	34	49	69.4	IEEE	34	69.4	RELX Group (Elsevier)	2	4.1
28	Rockwell Automation Inc	32	43	74.4	IEEE	32	74.4	AIAA-Am Inst Aero Astro	4	9.3
29	Schweitzer Engineering Labo	32	34	94.1	IEEE	32	94.1	IEC-International Electrotechnical Commission	1	2.9
30	Georgia Institute of Technolo	29	85	34.1	ACM-Assoc Comput Mach	47	55.3	IEEE	29	34.1
31	Microsoft Corporation	29	62	46.8	IEEE	29	46.8	ACM-Assoc Comput Mach	11	17.7
32	LS Electric co. Ltd. (formerly	27	35	77.1	IEEE	27	77.1	IET/IEE	4	11.4
33	ENERGY TECHNOLOGY G	26	30	86.7	IEEE	26	86.7	RELX Group (Elsevier)	2	6.7
34	Tigo Energy Inc	25	37	67.6	IEEE	25	67.6	WIP-Renewable Energies	9	24.3
35	SPARQ SYSTEMS INC	23	29	79.3	IEEE	23	79.3	RELX Group (Elsevier)	3	10.3
36	University of California	23	566	4.1	ACS-Am Chem Soc	169	29.9	Royal Society of Chemistry	94	16.6
37	Ecole Polytechnique Federale	22	26	84.6	IEEE	22	84.6	RELX Group (Elsevier)	3	11.5
38	Electro Industries Gauge Tec	22	47	46.8	IEEE	22	46.8	ACM-Assoc Comput Mach	9	19.1
39	Schneider Electric S.A.	21	104	20.2	ANSI-American National Standards Institute	27	26.0	IEEE	21	20.2

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	STEM INC	21	22	95.5	IEEE	21	95.5	RELX Group (Elsevier)	1	4.5
41	Taiwan Semiconductor Manu	21	39	53.8	IEEE	21	53.8	Electrostatic Discharge Association	15	38.5
42	Empire Technology Develop	20	24	83.3	IEEE	20	83.3	Condé Nast	2	8.3
43	Mitsubishi Electric Corp	20	21	95.2	IEEE	20	95.2	Hindawi Publishing Corporation	1	4.8
44	SENSE LABS INC	20	42	47.6	IEEE	20	47.6	RELX Group (Elsevier)	11	26.2
45	TEMPORAL POWER LTD	20	26	76.9	IEEE	20	76.9	NASA-National Aeronautics and Space Admin	2	7.7
46	Accenture Ltd.	19	25	76.0	IEEE	19	76.0	A B B Corporate Management Services AG	4	16.0
47	Panasonic Corporation	19	26	73.1	IEEE	19	73.1	Internet Soc/IETF-Internet Eng Task Force	2	7.7
48	Commscope Holding (formerl	18	18	100.0	IEEE	18	100.0			
49	Intellectual Ventures Manage	18	34	52.9	IEEE	18	52.9	RELX Group (Elsevier)	6	17.6
50	New Jersey Institute of Techn	17	17	100.0	IEEE	17	100.0			
51	Alphabet Inc.	16	42	38.1	IEEE	16	38.1	ACM-Assoc Comput Mach	10	23.8
52	Causam Energy Inc	16	30	53.3	IEEE	16	53.3	Springer Nature	7	23.3
53	Massachusetts Institute of Te	16	22	72.7	IEEE	16	72.7	AMER SOC NAVAL ENG INC	4	18.2
54	TAE TECHNOLOGIES INC	15	308	4.9	American Institute of Physics	149	48.4	American Physical Society	49	15.9
55	Toshiba Corp	14	22	63.6	IEEE	14	63.6	Internet Soc/IETF-Internet Eng Task Force	3	13.6
56	ENEDYM INC	13	18	72.2	IEEE	13	72.2	RELX Group (Elsevier)	1	5.6
57	Industrial Technology Researc	13	16	81.3	IEEE	13	81.3	RELX Group (Elsevier)	2	12.5
58	Sony Group Corp	13	45	28.9	SID-Society for Information Display	24	53.3	IEEE	13	28.9
59	THE FLORIDA INTERNATI	13	28	46.4	IEEE	13	46.4	The USENIX Association	4	14.3
60	CAUSAM ENTERPRISES I	12	20	60.0	IEEE	12	60.0	RELX Group (Elsevier)	3	15.0
61	Signify NV	12	14	85.7	IEEE	12	85.7	ACM-Assoc Comput Mach	1	7.1
62	United States of America Dep	12	38	31.6	IEEE	12	31.6	Optical Society of America	7	18.4
63	THE DETROIT EDISON CO	11	11	100.0	IEEE	11	100.0			
64	Alliance for Sustainable Ener	10	12	83.3	IEEE	10	83.3	Electric Power Research Institute	1	8.3
65	BRITISH COLUMBIA HYD	10	10	100.0	IEEE	10	100.0			
66	Landis & Gyr AG	10	11	90.9	IEEE	10	90.9	ANSI-American National Standards Institute	1	9.1
67	Nokia Corporation	10	20	50.0	IEEE	10	50.0	ACM-Assoc Comput Mach	3	15.0
68	Nth Degree Technologies Wo	10	96	10.4	Springer Nature	18	18.8	Optical Society of America	12	12.5
69	Roche Holding Ltd.	10	10	100.0	IEEE	10	100.0			
70	Cisco Systems Inc.	9	19	47.4	IEEE	9	47.4	Internet Soc/IETF-Internet Eng Task Force	7	36.8
71	Digimarc Corp.	9	9	100.0	IEEE	9	100.0			
72	Eaton Corp.	9	13	69.2	IEEE	9	69.2	IET/IEE	2	15.4
73	Energous Corporation	9	12	75.0	IEEE	9	75.0	The European Association on Antennas and Propagation (Eur	1	8.3
74	Fortive Corporation	9	15	60.0	IEEE	9	60.0	RELX Group (Elsevier)	5	33.3
75	Hon Hai Precision Industry C	9	34	26.5	ACM-Assoc Comput Mach	16	47.1	IEEE	9	26.5
76	INTERNATIONAL BROAD	9	17	52.9	IEEE	9	52.9	ISO-International Standards Organization	6	35.3
77	Johnson Controls Internationa	9	40	22.5	RELX Group (Elsevier)	12	30.0	IEEE	9	22.5
78	Northeastern University (Bost	9	13	69.2	IEEE	9	69.2	International Network for Scientific Information Publication (I	2	15.4
79	University of Missouri	9	10	90.0	IEEE	9	90.0	Summit Technical Media	1	10.0
80	Electricite de France	8	10	80.0	IEEE	8	80.0	RELX Group (Elsevier)	1	10.0

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Boeing Co. (The)	7	15	46.7	IEEE	7	46.7	Trans Tech Publications Ltd.	1	6.7
82	CLEAN POWER RESEARC	7	20	35.0	RELX Group (Elsevier)	11	55.0	IEEE	7	35.0
83	Clemson University	7	9	77.8	IEEE	7	77.8	American Institute of Physics	1	11.1
84	CURRENT GRID LLC	7	11	63.6	IEEE	7	63.6	Echelon Corp	2	18.2
85	CURRENT TECHNOLOGIE	7	12	58.3	IEEE	7	58.3	Hewlett-Packard Company	2	16.7
86	Danfoss A/S	7	7	100.0	IEEE	7	100.0			
87	King Fahd University of Petr	7	10	70.0	IEEE	7	70.0	United Business Media/UBM Tech	3	30.0
88	OPEN ACCESS TECHNOL	7	7	100.0	IEEE	7	100.0			
89	POWER TAGGING TECHN	7	8	87.5	IEEE	7	87.5	IET/IEE	1	12.5
90	TACTILIS SDN BHD	7	7	100.0	IEEE	7	100.0			
91	Tata Sons Ltd	7	9	77.8	IEEE	7	77.8	Very Large Data Base Endowment Inc. (VLDB Endowment)	1	11.1
92	UNIVERSITI BRUNEI DAR	7	8	87.5	IEEE	7	87.5	RELX Group (Elsevier)	1	12.5
93	AMRITA VISHWA VIDYAP	6	7	85.7	IEEE	6	85.7	IET/IEE	1	14.3
94	Bosch (Robert) GmbH	6	7	85.7	IEEE	6	85.7	American Institute of Physics	1	14.3
95	DEPSYS SA	6	6	100.0	IEEE	6	100.0			
96	EMPOWER MICRO SYSTE	6	6	100.0	IEEE	6	100.0			
97	Hello Inc	6	8	75.0	IEEE	6	75.0	ACM-Assoc Comput Mach	2	25.0
98	Korea Electrotechnology Res	6	6	100.0	IEEE	6	100.0			
99	NANOTECH ENERGY INC	6	192	3.1	ACS-Am Chem Soc	58	30.2	Royal Society of Chemistry	32	16.7
100	Oracle Corporation	6	18	33.3	IEEE	6	33.3	RELX Group (Elsevier)	4	22.2

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Solar/Photovoltaic</i>										
1	SolarEdge Technologies Inc	3197	4008	79.8	IEEE	3197	79.8	WIP-Renewable Energies	325	8.1
2	AMPT LLC	705	888	79.4	IEEE	705	79.4	RELX Group (Elsevier)	54	6.1
3	Sunpower Corp	494	823	60.0	IEEE	494	60.0	RELX Group (Elsevier)	99	12.0
4	SolAero Technologies Corp	443	872	50.8	IEEE	443	50.8	RELX Group (Elsevier)	135	15.5
5	Tigo Energy Inc	418	654	63.9	IEEE	418	63.9	WIP-Renewable Energies	177	27.1
6	University of Illinois	390	4363	8.9	American Institute of Physics	838	19.2	ACS-Am Chem Soc	798	18.3
7	Taiwan Semiconductor Manu	330	1611	20.5	American Institute of Physics	578	35.9	IEEE	330	20.5
8	International Business Machi	296	1498	19.8	RELX Group (Elsevier)	322	21.5	IEEE	296	19.8
9	Sanan Optoelectronics Techn	265	816	32.5	US Dept of Energy	399	48.9	IEEE	265	32.5
10	Emcore Corp.	246	488	50.4	IEEE	246	50.4	US Dept of Energy	76	15.6
11	California Institute of Techno	242	1483	16.3	IEEE	242	16.3	American Institute of Physics	230	15.5
12	Tesla Motors Inc	227	571	39.8	IEEE	227	39.8	WIP-Renewable Energies	97	17.0
13	Hanergy Holding Group Ltd	173	465	37.2	IEEE	173	37.2	American Institute of Physics	76	16.3
14	Xtrion NV	166	1753	9.5	American Institute of Physics	320	18.3	ACS-Am Chem Soc	312	17.8
15	Xerox Corp	153	499	30.7	IEEE	153	30.7	RELX Group (Elsevier)	96	19.2
16	SEMPRIUS INC	150	1692	8.9	American Institute of Physics	319	18.9	ACS-Am Chem Soc	307	18.1
17	Beamreach Solar Inc	135	626	21.6	RELX Group (Elsevier)	207	33.1	IEEE	135	21.6
18	Solar Junction Corp	126	666	18.9	American Institute of Physics	207	31.1	RELX Group (Elsevier)	170	25.5
19	Alliance for Sustainable Ener	119	975	12.2	American Institute of Physics	188	19.3	RELX Group (Elsevier)	175	17.9
20	SOLAREEDGE TECHNOLO	114	143	79.7	IEEE	114	79.7	RELX Group (Elsevier)	7	4.9
21	Enphase Energy Inc	112	122	91.8	IEEE	112	91.8	IET/IEE	4	3.3
22	CLEAN POWER RESEARC	109	286	38.1	RELX Group (Elsevier)	147	51.4	IEEE	109	38.1
23	The Arizona Board of Regent	103	472	21.8	RELX Group (Elsevier)	127	26.9	IEEE	103	21.8
24	Boeing Co. (The)	101	238	42.4	IEEE	101	42.4	RELX Group (Elsevier)	45	18.9
25	Massachusetts Institute of Te	96	771	12.5	RELX Group (Elsevier)	133	17.3	American Institute of Physics	98	12.7
26	Advanced Energy Industries I	84	91	92.3	IEEE	84	92.3	IET/IEE	4	4.4
27	Applied Materials Inc.	79	241	32.8	IEEE	79	32.8	WIP-Renewable Energies	51	21.2
28	Stion Corp	77	671	11.5	RELX Group (Elsevier)	225	33.5	American Institute of Physics	146	21.8
29	LG Electronics Inc.	75	232	32.3	IEEE	75	32.3	American Institute of Physics	47	20.3
30	Witricity Corp	72	134	53.7	IEEE	72	53.7	American Institute of Physics	11	8.2
31	Solyndra Inc	68	361	18.8	RELX Group (Elsevier)	117	32.4	IEEE	68	18.8
32	First Solar Inc	65	368	17.7	RELX Group (Elsevier)	161	43.8	IEEE	65	17.7
33	Nanosolar Inc	61	873	7.0	RELX Group (Elsevier)	248	28.4	Electrochemical Society, Inc.	107	12.3
34	Texas Instruments Inc	60	73	82.2	IEEE	60	82.2	United Business Media/UBM Tech	4	5.5
35	Lockheed Martin Corp.	59	236	25.0	IEEE	59	25.0	American Institute of Physics	37	15.7
36	Azur Space Solar Power Gmb	58	148	39.2	IEEE	58	39.2	RELX Group (Elsevier)	31	20.9
37	ZENA TECHNOLOGIES IN	55	234	23.5	IEEE	55	23.5	ACS-Am Chem Soc	49	20.9
38	United States Navy	53	200	26.5	IEEE	53	26.5	RELX Group (Elsevier)	32	16.0
39	Dartmouth College	48	93	51.6	IEEE	48	51.6	RELX Group (Elsevier)	18	19.4

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	General Electric Company	47	308	15.3	ACS-Am Chem Soc	83	26.9	IEEE	47	15.3
41	Ignis Innovation Inc	45	67	67.2	IEEE	45	67.2	SID-Society for Information Display	16	23.9
42	SUNIVA INC	45	88	51.1	IEEE	45	51.1	WIP-Renewable Energies	12	13.6
43	University of Minnesota (The	45	108	41.7	IEEE	45	41.7	American Institute of Physics	25	23.1
44	ARRAY PHOTONICS INC	42	217	19.4	American Institute of Physics	68	31.3	RELX Group (Elsevier)	44	20.3
45	Canon Inc	41	120	34.2	IEEE	41	34.2	American Institute of Physics	18	15.0
46	DuPont de Nemours Inc.	39	241	16.2	RELX Group (Elsevier)	87	36.1	IEEE	39	16.2
47	University of California	39	1118	3.5	ACS-Am Chem Soc	258	23.1	RELX Group (Elsevier)	165	14.8
48	Commissariat A L'Energie At	37	269	13.8	RELX Group (Elsevier)	102	37.9	ACS-Am Chem Soc	38	14.1
49	University of Toledo	37	142	26.1	RELX Group (Elsevier)	82	57.7	IEEE	37	26.1
50	Honeywell International Inc.	36	1068	3.4	ACS-Am Chem Soc	405	37.9	RELX Group (Elsevier)	198	18.5
51	Hon Hai Precision Industry C	35	218	16.1	RELX Group (Elsevier)	41	18.8	IEEE	35	16.1
52	Ostendo Technologies Inc	35	96	36.5	IEEE	35	36.5	RELX Group (Elsevier)	29	30.2
53	4POWER LLC	34	66	51.5	IEEE	34	51.5	American Institute of Physics	18	27.3
54	Compagnie de Saint-Gobain	34	172	19.8	SPIE-Int Soc Opt Engineering	40	23.3	RELX Group (Elsevier)	35	20.3
55	Solarworld Industries GmbH	32	99	32.3	IEEE	32	32.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	19	19.2
56	Industrial Techology Researc	31	214	14.5	RELX Group (Elsevier)	55	25.7	IEEE	31	14.5
57	Semiconductor Energy Labor	31	547	5.7	SID-Society for Information Display	200	36.6	American Institute of Physics	80	14.6
58	Teijin Ltd.	30	86	34.9	IEEE	30	34.9	WIP-Renewable Energies	24	27.9
59	AMI RESAERCH & DEVEL	28	72	38.9	IEEE	28	38.9	Optical Society of America	8	11.1
60	GTAT Corp (AT Advanced T	28	127	22.0	IEEE	28	22.0	American Institute of Physics	25	19.7
61	Interuniversity MicroElectron	28	129	21.7	RELX Group (Elsevier)	33	25.6	IEEE	28	21.7
62	Koch Industries Inc	28	329	8.5	RELX Group (Elsevier)	131	39.8	American Institute of Physics	84	25.5
63	The National Aeronautical an	28	206	13.6	Springer Nature	29	14.1	IEEE	28	13.6
64	Panasonic Corporation	27	188	14.4	American Institute of Physics	46	24.5	RELX Group (Elsevier)	35	18.6
65	ACORN SEMI LLC	25	162	15.4	American Institute of Physics	63	38.9	RELX Group (Elsevier)	37	22.8
66	Hanwha Solutions (Hhanwha	25	83	30.1	IEEE	25	30.1	American Institute of Physics	19	22.9
67	Imperial College	25	81	30.9	IEEE	25	30.9	American Institute of Physics	23	28.4
68	Nth Degree Technologies Wo	25	250	10.0	Springer Nature	47	18.8	Optical Society of America	32	12.8
69	University of Alabama	25	47	53.2	IEEE	25	53.2	American Institute of Physics	5	10.6
70	University of Michigan	25	367	6.8	American Institute of Physics	90	24.5	ACS-Am Chem Soc	67	18.3
71	INDIVIDUAL PATENTER	24	159	15.1	American Institute of Physics	24	15.1	IEEE	24	15.1
72	Precursor Energetics Inc	23	1095	2.1	ACS-Am Chem Soc	481	43.9	RELX Group (Elsevier)	237	21.6
73	Qualcomm Inc	23	66	34.8	IEEE	23	34.8	SID-Society for Information Display	11	16.7
74	Solopower Inc	23	213	10.8	RELX Group (Elsevier)	101	47.4	American Institute of Physics	43	20.2
75	ENEOS Group (formerly JXT	22	85	25.9	IEEE	22	25.9	RELX Group (Elsevier)	20	23.5
76	Fraunhofer Gesellschaft	22	89	24.7	IEEE	22	24.7	RELX Group (Elsevier)	21	23.6
77	King Abdullah University of	22	278	7.9	ACS-Am Chem Soc	83	29.9	Royal Society of Chemistry	36	12.9
78	Shin-Etsu Chemical Co. Ltd.	22	66	33.3	IEEE	22	33.3	RELX Group (Elsevier)	11	16.7
79	City University of Hong Kon	21	38	55.3	IEEE	21	55.3	IET/IEE	12	31.6
80	Total SA	21	65	32.3	IEEE	21	32.3	RELX Group (Elsevier)	13	20.0

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81	Catholic University Leuven	20	57	35.1	IEEE	20	35.1	RELX Group (Elsevier)	13	22.8
82	Toyota Motor Corp	20	101	19.8	Optical Society of America	22	21.8	IEEE	20	19.8
83	Toshiba Corp	19	121	15.7	ACS-Am Chem Soc	26	21.5	IEEE	19	15.7
84	University of New Mexico	19	57	33.3	IEEE	19	33.3	RELX Group (Elsevier)	12	21.1
85	ATHENAEUM LLC	18	104	17.3	RELX Group (Elsevier)	30	28.8	IEEE	18	17.3
86	FLISOM AG	18	107	16.8	RELX Group (Elsevier)	45	42.1	IEEE	18	16.8
87	Laird Ltd	18	63	28.6	IEEE	18	28.6	American Institute of Physics	16	25.4
88	New Jersey Institute of Techn	18	34	52.9	IEEE	18	52.9	RELX Group (Elsevier)	10	29.4
89	SMA Solar Technology AG	18	20	90.0	IEEE	18	90.0	RELX Group (Elsevier)	1	5.0
90	1366 TECHNOLOGIES INC	17	93	18.3	RELX Group (Elsevier)	49	52.7	IEEE	17	18.3
91	ASCENT SOLAR TECHNO	17	52	32.7	IEEE	17	32.7	RELX Group (Elsevier)	13	25.0
92	BEIJING APOLLO DING R	17	84	20.2	RELX Group (Elsevier)	27	32.1	IEEE	17	20.2
93	Raytheon Co.	17	66	25.8	IEEE	17	25.8	RELX Group (Elsevier)	9	13.6
94	VERLIY LIFE SCIENCES L	17	38	44.7	IEEE	17	44.7	RELX Group (Elsevier)	4	10.5
95	Columbia University	16	234	6.8	ACS-Am Chem Soc	97	41.5	American Institute of Physics	21	9.0
96	PLANT PV INC	16	62	25.8	RELX Group (Elsevier)	21	33.9	IEEE	16	25.8
97	Reliance Industries Ltd	16	41	39.0	IEEE	16	39.0	WIP-Renewable Energies	11	26.8
98	Rensselaer Polytechnic Instit	16	63	25.4	IEEE	16	25.4	American Institute of Physics	15	23.8
99	Stanford University	16	163	9.8	American Institute of Physics	29	17.8	ACS-Am Chem Soc	29	17.8
100	Ecole Polytechnique Federale	15	142	10.6	ACS-Am Chem Soc	45	31.7	RELX Group (Elsevier)	20	14.1

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Telecom and Other Communications</i>										
1	AT&T Inc	32135	69710	46.1	IEEE	32135	46.1	RELX Group (Elsevier)	3412	4.9
2	Qualcomm Inc	29698	91081	32.6	IEEE	29698	32.6	3GPP General Partnership Project Standards Body	26673	29.3
3	Marvell Technology Group Lt	22695	28770	78.9	IEEE	22695	78.9	3GPP General Partnership Project Standards Body	3177	11.0
4	Broadcom Ltd	18406	28285	65.1	IEEE	18406	65.1	International Telecommunication Union	1185	4.2
5	Microsoft Corporation	17646	44015	40.1	IEEE	17646	40.1	ACM-Assoc Comput Mach	6846	15.6
6	InterDigital Inc	13008	65088	20.0	3GPP General Partnership Project Standards B	44344	68.1	IEEE	13008	20.0
7	Intel Corporation	12526	29682	42.2	IEEE	12526	42.2	3GPP General Partnership Project Standards Body	9606	32.4
8	Nokia Corporation	12498	37177	33.6	IEEE	12498	33.6	3GPP General Partnership Project Standards Body	12271	33.0
9	Ericsson	12197	53198	22.9	3GPP General Partnership Project Standards B	26882	50.5	IEEE	12197	22.9
10	Cisco Systems Inc.	11826	43395	27.3	IEEE	11826	27.3	Internet Soc/IETF-Internet Eng Task Force	7218	16.6
11	Huawei Technologies Compa	11617	50815	22.9	3GPP General Partnership Project Standards B	26708	52.6	IEEE	11617	22.9
12	REARDEN LLC	9908	12393	79.9	IEEE	9908	79.9	3GPP General Partnership Project Standards Body	735	5.9
13	ParkerVision Inc	9689	18988	51.0	IEEE	9689	51.0	IET/IEE	4376	23.0
14	Samsung Electronics Co Ltd	9234	39107	23.6	3GPP General Partnership Project Standards B	21292	54.4	IEEE	9234	23.6
15	International Business Machi	9180	26374	34.8	IEEE	9180	34.8	ACM-Assoc Comput Mach	3679	13.9
16	Apple Inc	8385	22512	37.2	IEEE	8385	37.2	3GPP General Partnership Project Standards Body	3675	16.3
17	LG Electronics Inc.	7945	50619	15.7	3GPP General Partnership Project Standards B	33773	66.7	IEEE	7945	15.7
18	Xperi Holding Corporation (F	7795	20827	37.4	IEEE	7795	37.4	SPIE-Int Soc Opt Engineering	1924	9.2
19	Personalized Media Commun	6988	41733	16.7	Society of Motion Picture and Television Engi	12649	30.3	IEEE	6988	16.7
20	Sony Group Corp	6612	18970	34.9	IEEE	6612	34.9	3GPP General Partnership Project Standards Body	4223	22.3
21	Alphabet Inc.	6564	20195	32.5	IEEE	6564	32.5	International Telecommunication Union	2790	13.8
22	Panasonic Corporation	6323	19386	32.6	3GPP General Partnership Project Standards B	6434	33.2	IEEE	6323	32.6
23	Massachusetts Institute of Te	6225	11851	52.5	IEEE	6225	52.5	Optical Society of America	795	6.7
24	Fractus SA	5696	10108	56.4	IEEE	5696	56.4	IET/IEE	1365	13.5
25	Commscope Holding (formerl	5600	9660	58.0	IEEE	5600	58.0	3GPP General Partnership Project Standards Body	506	5.2
26	Murata Manufacturing Co. Lt	5281	6793	77.7	IEEE	5281	77.7	RELX Group (Elsevier)	190	2.8
27	Blackberry Ltd.	4918	22669	21.7	3GPP General Partnership Project Standards B	12032	53.1	IEEE	4918	21.7
28	NXP Semiconductors NV	4776	6153	77.6	IEEE	4776	77.6	3GPP General Partnership Project Standards Body	128	2.1
29	Adaptix	4375	6474	67.6	IEEE	4375	67.6	European Telecom Standards Institute (ETSI)	730	11.3
30	Fujitsu Limited	4260	12993	32.8	IEEE	4260	32.8	3GPP General Partnership Project Standards Body	3749	28.9
31	Nippon Telegraph & Telepho	4179	14843	28.2	3GPP General Partnership Project Standards B	5848	39.4	IEEE	4179	28.2
32	Rambus Inc.	4157	5982	69.5	IEEE	4157	69.5	IEEE/JPN Soc App Phys	298	5.0
33	Raytheon Co.	3660	6593	55.5	IEEE	3660	55.5	Optical Society of America	234	3.5
34	Electronics and Telecommuni	3570	7610	46.9	IEEE	3570	46.9	3GPP General Partnership Project Standards Body	1445	19.0
35	NEC Corp	3453	15328	22.5	3GPP General Partnership Project Standards B	8146	53.1	IEEE	3453	22.5
36	Texas Instruments Inc	3447	6310	54.6	IEEE	3447	54.6	International Telecommunication Union	1271	20.1
37	University of Minnesota (The	3446	4131	83.4	IEEE	3446	83.4	ACM-Assoc Comput Mach	68	1.6
38	RPX Corp	3363	8025	41.9	IEEE	3363	41.9	IEEE/OSA	822	10.2
39	L3 Harris Technologies (form	3234	5259	61.5	IEEE	3234	61.5	Internet Soc/IETF-Internet Eng Task Force	247	4.7

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Comcast Corp	3202	31390	10.2	3GPP General Partnership Project Standards B	26198	83.5	IEEE	3202	10.2
41	Columbia University	3161	5684	55.6	IEEE	3161	55.6	ACM-Assoc Comput Mach	585	10.3
42	Analog Devices Inc.	3081	4059	75.9	IEEE	3081	75.9	ACM-Assoc Comput Mach	123	3.0
43	CPG TECHNOLOGIES LLC	3075	5697	54.0	IEEE	3075	54.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	636	11.2
44	Conversant Intellectual Prope	3033	5842	51.9	IEEE	3033	51.9	3GPP General Partnership Project Standards Body	252	4.3
45	Toshiba Corp	2905	5463	53.2	IEEE	2905	53.2	International Telecommunication Union	499	9.1
46	STMicroelectronics	2871	4093	70.1	IEEE	2871	70.1	European Telecom Standards Institute (ETSI)	123	3.0
47	Industrial Techology Researc	2759	4341	63.6	IEEE	2759	63.6	3GPP General Partnership Project Standards Body	508	11.7
48	Advanced Micro Devices Inc	2670	6679	40.0	IEEE	2670	40.0	ACM-Assoc Comput Mach	2315	34.7
49	Motorola Solutions Inc.	2608	4649	56.1	IEEE	2608	56.1	3GPP General Partnership Project Standards Body	391	8.4
50	Technicolor SA	2460	5315	46.3	IEEE	2460	46.3	ISO/IEC/JTC/ANSI	329	6.2
51	Mitsubishi Electric Corp	2424	6583	36.8	IEEE	2424	36.8	3GPP General Partnership Project Standards Body	1889	28.7
52	Honeywell International Inc.	2393	4712	50.8	IEEE	2393	50.8	RELX Group (Elsevier)	197	4.2
53	Corning Inc.	2303	4119	55.9	IEEE	2303	55.9	IET/IEE	326	7.9
54	Infineon Technologies AG	2296	3372	68.1	IEEE	2296	68.1	IET/IEE	94	2.8
55	University of California	2234	4062	55.0	IEEE	2234	55.0	Optical Society of America	208	5.1
56	Renesas Electronic Corporati	2211	3588	61.6	IEEE	2211	61.6	IEEE/OSA	217	6.0
57	SIPCO LLC	2158	3823	56.4	IEEE	2158	56.4	Internet Soc/IETF-Internet Eng Task Force	315	8.2
58	Semiconductor Energy Labor	2115	26963	7.8	SID-Society for Information Display	9964	37.0	American Institute of Physics	3284	12.2
59	Verizon Communications Inc	2108	6006	35.1	IEEE	2108	35.1	Internet Soc/IETF-Internet Eng Task Force	1223	20.4
60	SUN PATENT TRUST	2106	12361	17.0	3GPP General Partnership Project Standards B	4335	35.1	International Telecommunication Union	4177	33.8
61	Silicon Laboratories Inc	2092	2669	78.4	IEEE	2092	78.4	RELX Group (Elsevier)	119	4.5
62	Digimarc Corp.	2079	5161	40.3	IEEE	2079	40.3	SPIE-Int Soc Opt Engineering	606	11.7
63	Fraunhofer Gesellschaft	2070	4278	48.4	IEEE	2070	48.4	International Telecommunication Union	328	7.7
64	Viasat	2010	3101	64.8	IEEE	2010	64.8	AIAA-Am Inst Aero Astro	211	6.8
65	General Electric Company	1975	6313	31.3	International Telecommunication Union	2104	33.3	IEEE	1975	31.3
66	Mediatek Inc.	1957	5198	37.6	IEEE	1957	37.6	3GPP General Partnership Project Standards Body	1500	28.9
67	HRL Laboratories LLC	1895	3396	55.8	IEEE	1895	55.8	IET/IEE	244	7.2
68	Quarterhill Inc	1838	3479	52.8	IEEE	1838	52.8	3GPP General Partnership Project Standards Body	576	16.6
69	Intellectual Ventures Manage	1789	4812	37.2	IEEE	1789	37.2	3GPP General Partnership Project Standards Body	340	7.1
70	Oracle Corporation	1768	7695	23.0	IEEE	1768	23.0	3GPP General Partnership Project Standards Body	1520	19.8
71	Micron Technology Inc.	1756	2839	61.9	IEEE	1756	61.9	RELX Group (Elsevier)	152	5.4
72	Juniper Networks Inc.	1754	6427	27.3	Network Working Group RFC	1958	30.5	IEEE	1754	27.3
73	Qorvo	1735	2317	74.9	IEEE	1735	74.9	European Microwave Association	84	3.6
74	Amazon.com Inc.	1722	6540	26.3	IEEE	1722	26.3	ACM-Assoc Comput Mach	1057	16.2
75	Dolby Laboratories Inc	1698	6584	25.8	International Telecommunication Union	1886	28.6	IEEE	1698	25.8
76	California Institute of Techno	1696	3670	46.2	IEEE	1696	46.2	Optical Society of America	357	9.7
77	Koninklijke Philips N.V.	1669	3657	45.6	IEEE	1669	45.6	3GPP General Partnership Project Standards Body	359	9.8
78	Hon Hai Precision Industry C	1623	13236	12.3	3GPP General Partnership Project Standards B	8337	63.0	IEEE	1623	12.3
79	Boeing Co. (The)	1612	3211	50.2	IEEE	1612	50.2	RELX Group (Elsevier)	120	3.7
80	Kandou	1609	1773	90.8	IEEE	1609	90.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	67	3.8

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	GENGHISCOMM HOLDIN	1520	1871	81.2	IEEE	1520	81.2	3GPP General Partnership Project Standards Body	79	4.2
82	Cubic Corporation	1428	1971	72.5	IEEE	1428	72.5	The International Society of Infrared, Millimeter, and Terahert	105	5.3
83	Canon Inc	1420	3536	40.2	IEEE	1420	40.2	International Telecommunication Union	540	15.3
84	University of Washington	1395	2588	53.9	IEEE	1395	53.9	ACM-Assoc Comput Mach	349	13.5
85	Hewlett Packard Enterprises	1380	3652	37.8	IEEE	1380	37.8	ACM-Assoc Comput Mach	447	12.2
86	NXGEN PARTNERS IP LLC	1379	2887	47.8	IEEE	1379	47.8	Optical Society of America	743	25.7
87	CONSTELLATION DESIGN	1377	1631	84.4	IEEE	1377	84.4	IET/IEE	46	2.8
88	HP Inc	1373	3696	37.1	IEEE	1373	37.1	ACM-Assoc Comput Mach	416	11.3
89	T-Mobile USA INC	1351	5378	25.1	IEEE	1351	25.1	3GPP General Partnership Project Standards Body	781	14.5
90	ORIGIN WIRELESS INC	1326	1998	66.4	IEEE	1326	66.4	American Physical Society	129	6.5
91	Tabula Inc	1316	3547	37.1	ACM-Assoc Comput Mach	1337	37.7	IEEE	1316	37.1
92	LibertyMedia	1302	2391	54.5	IEEE	1302	54.5	ACM-Assoc Comput Mach	193	8.1
93	Microchip Technology Inc.	1280	1949	65.7	IEEE	1280	65.7	International Telecommunication Union	106	5.4
94	Xerox Corp	1267	3652	34.7	IEEE	1267	34.7	ACM-Assoc Comput Mach	863	23.6
95	NVIDIA Corp.	1225	2602	47.1	IEEE	1225	47.1	ACM-Assoc Comput Mach	213	8.2
96	Siemens Aktiengesellschaft	1225	2713	45.2	IEEE	1225	45.2	3GPP General Partnership Project Standards Body	228	8.4
97	Wisteria Trading Inc	1205	2478	48.6	IEEE	1205	48.6	SPIE-Int Soc Opt Engineering	288	11.6
98	The Arizona Board of Regent	1174	2411	48.7	IEEE	1174	48.7	ACM-Assoc Comput Mach	270	11.2
99	BT Group PLC	1165	2705	43.1	IEEE	1165	43.1	3GPP General Partnership Project Standards Body	260	9.6
100	Lenovo Group Ltd	1134	4959	22.9	3GPP General Partnership Project Standards B	3188	64.3	IEEE	1134	22.9

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Virtual/Augmented Reality</i>										
1	Microsoft Corporation	3492	9476	36.9	IEEE	3492	36.9	ACM-Assoc Comput Mach	2340	24.7
2	Immersion Corp.	1213	3428	35.4	IEEE	1213	35.4	ACM-Assoc Comput Mach	388	11.3
3	Magic Leap Inc	1150	3696	31.1	IEEE	1150	31.1	ACM-Assoc Comput Mach	416	11.3
4	Apple Inc	1138	3070	37.1	IEEE	1138	37.1	ACM-Assoc Comput Mach	659	21.5
5	Alphabet Inc.	968	3116	31.1	IEEE	968	31.1	ACM-Assoc Comput Mach	763	24.5
6	Meta Platforms Inc.(formerly	551	2053	26.8	IEEE	551	26.8	ACM-Assoc Comput Mach	481	23.4
7	Sony Group Corp	507	1232	41.2	IEEE	507	41.2	ACM-Assoc Comput Mach	227	18.4
8	Qualcomm Inc	364	1020	35.7	IEEE	364	35.7	ACM-Assoc Comput Mach	175	17.2
9	Lincoln Electric Holdings Inc	303	1609	18.8	ACM-Assoc Comput Mach	444	27.6	IEEE	303	18.8
10	International Business Machi	299	1144	26.1	IEEE	299	26.1	ACM-Assoc Comput Mach	222	19.4
11	The Arizona Board of Regent	279	1952	14.3	Optical Society of America	585	30.0	IEEE	279	14.3
12	Intellectual Ventures Manage	249	750	33.2	IEEE	249	33.2	ACM-Assoc Comput Mach	157	20.9
13	P4TENTS1 LLC	229	532	43.0	IEEE	229	43.0	ACM-Assoc Comput Mach	79	14.8
14	Xperi Holding Corporation (F	203	456	44.5	IEEE	203	44.5	SPIE-Int Soc Opt Engineering	58	12.7
15	AT&T Inc	201	518	38.8	IEEE	201	38.8	ACM-Assoc Comput Mach	150	29.0
16	Ultrahaptics Ltd.	201	570	35.3	IEEE	201	35.3	ACM-Assoc Comput Mach	141	24.7
17	ONPOINT MEDICAL INC	196	865	22.7	IEEE	196	22.7	RELX Group (Elsevier)	142	16.4
18	Intel Corporation	192	461	41.6	IEEE	192	41.6	ACM-Assoc Comput Mach	109	23.6
19	Samsung Electronics Co Ltd	169	443	38.1	IEEE	169	38.1	ACM-Assoc Comput Mach	93	21.0
20	3D Systems Corp.	166	356	46.6	IEEE	166	46.6	ACM-Assoc Comput Mach	90	25.3
21	University of North Carolina	163	571	28.5	IEEE	163	28.5	ACM-Assoc Comput Mach	151	26.4
22	Massachusetts Institute of Te	158	601	26.3	IEEE	158	26.3	ACM-Assoc Comput Mach	69	11.5
23	Adobe Inc. (former Adobe Sy	139	524	26.5	ACM-Assoc Comput Mach	221	42.2	IEEE	139	26.5
24	AUGMENTED VISION INC	134	1062	12.6	Optical Society of America	363	34.2	SPIE-Int Soc Opt Engineering	157	14.8
25	Nokia Corporation	124	307	40.4	IEEE	124	40.4	ACM-Assoc Comput Mach	56	18.2
26	Ostendo Technologies Inc	124	477	26.0	IEEE	124	26.0	ACM-Assoc Comput Mach	87	18.2
27	BRAINGATE CO LLC	120	308	39.0	IEEE	120	39.0	RELX Group (Elsevier)	45	14.6
28	Walt Disney Co.	116	335	34.6	IEEE	116	34.6	ACM-Assoc Comput Mach	95	28.4
29	Digimarc Corp.	109	249	43.8	IEEE	109	43.8	ACM-Assoc Comput Mach	39	15.7
30	Medtronic Inc	108	223	48.4	IEEE	108	48.4	Springer Nature	20	9.0
31	Intuitive Surgical Inc.	107	256	41.8	IEEE	107	41.8	The Medical Image Computing and Computer Assisted Interve	30	11.7
32	Empire Technology Develop	84	248	33.9	IEEE	84	33.9	ACM-Assoc Comput Mach	27	10.9
33	TANGIS CORP	84	532	15.8	Joint IEEE and ACM	281	52.8	ACM-Assoc Comput Mach	96	18.0
34	Tobii Ab	82	185	44.3	IEEE	82	44.3	ACM-Assoc Comput Mach	54	29.2
35	Nant Holdings IP Llc	80	155	51.6	IEEE	80	51.6	Dow Jones & Co.	9	5.8
36	Cortica Ltd	77	110	70.0	IEEE	77	70.0	ACM-Assoc Comput Mach	14	12.7
37	InterDigital Inc	77	230	33.5	IEEE	77	33.5	ACM-Assoc Comput Mach	65	28.3
38	MIDDLE CHART LLC	77	102	75.5	IEEE	77	75.5	Multidisciplinary Digital Publishing Institute (MDPI)	25	24.5
39	INDIVIDUAL PATENTER	76	280	27.1	IEEE	76	27.1	RELX Group (Elsevier)	69	24.6

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Amazon.com Inc.	75	271	27.7	ACM-Assoc Comput Mach	106	39.1	IEEE	75	27.7
41	D3D TECHNOLOGIES INC	74	165	44.8	IEEE	74	44.8	RELX Group (Elsevier)	16	9.7
42	HRL Laboratories LLC	73	202	36.1	IEEE	73	36.1	ACM-Assoc Comput Mach	19	9.4
43	Canon Inc	71	236	30.1	IEEE	71	30.1	ACM-Assoc Comput Mach	45	19.1
44	Toyota Motor Corp	71	197	36.0	IEEE	71	36.0	ACM-Assoc Comput Mach	35	17.8
45	Stanford University	69	201	34.3	IEEE	69	34.3	ACM-Assoc Comput Mach	20	10.0
46	Bosch (Robert) GmbH	66	103	64.1	IEEE	66	64.1	ACM-Assoc Comput Mach	7	6.8
47	GoPro Inc	65	130	50.0	IEEE	65	50.0	ACM-Assoc Comput Mach	16	12.3
48	Honda Motor Co. Ltd.(Honda	65	124	52.4	IEEE	65	52.4	RELX Group (Elsevier)	13	10.5
49	BUTTERFLY NETWORKS I	60	68	88.2	IEEE	60	88.2	Acoustical Society of America	4	5.9
50	Snap Inc	60	157	38.2	IEEE	60	38.2	RELX Group (Elsevier)	33	21.0
51	Lockheed Martin Corp.	59	280	21.1	IEEE	59	21.1	SPIE-Int Soc Opt Engineering	44	15.7
52	ELECTRONIC SCRIPTING	58	146	39.7	IEEE	58	39.7	Joint IEEE and ACM	26	17.8
53	Nio Co. Ltd	58	121	47.9	IEEE	58	47.9	CBS Interactive	21	17.4
54	NVIDIA Corp.	57	222	25.7	ACM-Assoc Comput Mach	64	28.8	IEEE	57	25.7
55	APPLIED RESEARCH ASS	56	115	48.7	IEEE	56	48.7	SPIE-Int Soc Opt Engineering	14	12.2
56	Autodesk Inc.	56	407	13.8	ACM-Assoc Comput Mach	272	66.8	IEEE	56	13.8
57	Siemens Aktiengesellschaft	53	151	35.1	IEEE	53	35.1	Joint IEEE and ACM	32	21.2
58	ULTRAHAPTICS IP TWO L	52	132	39.4	IEEE	52	39.4	ACM-Assoc Comput Mach	28	21.2
59	ORCAM TECHNOLOGIES	51	60	85.0	IEEE	51	85.0	Springer Nature	4	6.7
60	Technicolor SA	48	86	55.8	IEEE	48	55.8	RELX Group (Elsevier)	6	7.0
61	California Institute of Techno	47	143	32.9	IEEE	47	32.9	American Physiological Society	18	12.6
62	MENTOR ACQUISITION O	47	157	29.9	ACM-Assoc Comput Mach	52	33.1	IEEE	47	29.9
63	University of Connecticut	46	379	12.1	Optical Society of America	124	32.7	SPIE-Int Soc Opt Engineering	60	15.8
64	Johnson & Johnson	45	156	28.8	RELX Group (Elsevier)	46	29.5	IEEE	45	28.8
65	Surefire LLC	44	55	80.0	IEEE	44	80.0	IEEE/OSA	11	20.0
66	Harvard University	42	186	22.6	IEEE	42	22.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	30	16.1
67	Ohio State University	42	79	53.2	IEEE	42	53.2	ACM-Assoc Comput Mach	9	11.4
68	BERTEC CORP	40	63	63.5	IEEE	40	63.5	American Association of Physics Teachers	9	14.3
69	Honeywell International Inc.	39	91	42.9	IEEE	39	42.9	RELX Group (Elsevier)	7	7.7
70	Cisco Systems Inc.	37	89	41.6	IEEE	37	41.6	Internet Soc/IETF-Internet Eng Task Force	10	11.2
71	Fujitsu Limited	36	84	42.9	IEEE	36	42.9	ACM-Assoc Comput Mach	14	16.7
72	Nintendo Co. Ltd.	36	196	18.4	Nintendo of America	79	40.3	IEEE	36	18.4
73	Acuity Brands Inc.	34	65	52.3	IEEE	34	52.3	Springer Nature	15	23.1
74	Comcast Corp	34	92	37.0	IEEE	34	37.0	SPIE-Int Soc Opt Engineering	25	27.2
75	HP Inc	34	103	33.0	ACM-Assoc Comput Mach	38	36.9	IEEE	34	33.0
76	Boeing Co. (The)	33	95	34.7	IEEE	33	34.7	ACM-Assoc Comput Mach	12	12.6
77	L3 Harris Technologies (form	33	70	47.1	IEEE	33	47.1	Joint IEEE and ACM	7	10.0
78	Panasonic Corporation	33	73	45.2	IEEE	33	45.2	RELX Group (Elsevier)	7	9.6
79	GlowPoint Inc.	32	48	66.7	IEEE	32	66.7	ACM-Assoc Comput Mach	16	33.3
80	Rag Foundation	32	46	69.6	IEEE	32	69.6	RELX Group (Elsevier)	8	17.4

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Adidas AG	31	119	26.1	IEEE	31	26.1	RELX Group (Elsevier)	12	10.1
82	Drexel University	31	158	19.6	RELX Group (Elsevier)	43	27.2	IEEE	31	19.6
83	LEGEND3D INC	31	53	58.5	IEEE	31	58.5	ACM-Assoc Comput Mach	9	17.0
84	North Carolina State Universi	31	49	63.3	IEEE	31	63.3	RELX Group (Elsevier)	3	6.1
85	Oracle Corporation	31	70	44.3	IEEE	31	44.3	ACM-Assoc Comput Mach	23	32.9
86	Seiko Epson Corporation	31	130	23.8	Joint IEEE and ACM	50	38.5	IEEE	31	23.8
87	Uber Technologies Inc	31	70	44.3	IEEE	31	44.3	Joint IET and IEEE	11	15.7
88	ARTILUX INC	30	58	51.7	IEEE	30	51.7	Optical Society of America	10	17.2
89	Huawei Technologies Compa	30	71	42.3	IEEE	30	42.3	ACM-Assoc Comput Mach	11	15.5
90	ZSPACE INC	30	126	23.8	IEEE	30	23.8	ACM-Assoc Comput Mach	29	23.0
91	ULTIMATEPOINTER LLC	29	63	46.0	IEEE	29	46.0	ACM-Assoc Comput Mach	24	38.1
92	University of South Florida	29	72	40.3	IEEE	29	40.3	RELX Group (Elsevier)	13	18.1
93	State University of New York	28	57	49.1	IEEE	28	49.1	ACM-Assoc Comput Mach	23	40.4
94	INNEREYE LTD	27	35	77.1	IEEE	27	77.1	SPIE-Int Soc Opt Engineering	6	17.1
95	HELP LIGHTING INC	26	221	11.8	ACM-Assoc Comput Mach	121	54.8	IEEE	26	11.8
96	University System of Maryla	26	97	26.8	IEEE	26	26.8	Springer Nature	11	11.3
97	University of Washington	25	129	19.4	IEEE	25	19.4	Springer Nature	11	8.5
98	Johns Hopkins University	24	47	51.1	IEEE	24	51.1	Joint IEEE and ACM	4	8.5
99	Koninklijke Philips N.V.	24	84	28.6	IEEE	24	28.6	ACM-Assoc Comput Mach	15	17.9
100	POSITION IMAGING INC	24	24	100.0	IEEE	24	100.0			

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Wind Energy</i>										
1	Vestas Wind Systems A/S	464	1004	46.2	IEEE	464	46.2	AWEA-American Wind Energy Association	98	9.8
2	General Electric Company	255	708	36.0	IEEE	255	36.0	US Dept of Energy	116	16.4
3	ABB Ltd	147	268	54.9	IEEE	147	54.9	EWEA-European Wind Energy Association	29	10.8
4	University of Nebraska	126	162	77.8	IEEE	126	77.8	RELX Group (Elsevier)	21	13.0
5	The Arizona Board of Regent	92	137	67.2	IEEE	92	67.2	RELX Group (Elsevier)	10	7.3
6	Enercon GmbH	67	93	72.0	IEEE	67	72.0	RELX Group (Elsevier)	12	12.9
7	Siemens Aktiengesellschaft	63	113	55.8	IEEE	63	55.8	RELX Group (Elsevier)	13	11.5
8	SolarEdge Technologies Inc	61	76	80.3	IEEE	61	80.3	WIP-Renewable Energies	7	9.2
9	Siemens Energy Ag (formerly	48	101	47.5	IEEE	48	47.5	AIAA-Am Inst Aero Astro	12	11.9
10	Ingteam Corporation SA	46	77	59.7	IEEE	46	59.7	Oxford University Press	6	7.8
11	University of Alabama	34	42	81.0	IEEE	34	81.0	IET/IEE	6	14.3
12	Rensselaer Polytechnic Instit	25	30	83.3	IEEE	25	83.3	AIAA-Am Inst Aero Astro	2	6.7
13	University of New Brunswick	25	27	92.6	IEEE	25	92.6	IET/IEE	1	3.7
14	Tigo Energy Inc	23	35	65.7	IEEE	23	65.7	WIP-Renewable Energies	9	25.7
15	National Cheng Kung Univer	18	19	94.7	IEEE	18	94.7	IET/IEE	1	5.3
16	INDIVIDUAL PATENTER	17	36	47.2	IEEE	17	47.2	ASME-Am Soc Mech Eng	7	19.4
17	UWM Research Foundation	17	19	89.5	IEEE	17	89.5	IET/IEE	1	5.3
18	Nordex SE	15	23	65.2	IEEE	15	65.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	4	17.4
19	NRG SYSTEMS INC	14	24	58.3	IEEE	14	58.3	RELX Group (Elsevier)	4	16.7
20	University of South Florida	14	14	100.0	IEEE	14	100.0			
21	UPTAKE TECHNOLOGIES	14	19	73.7	IEEE	14	73.7	National Institute of Standards and Technology (NIST)	3	15.8
22	TechnipFMC	13	17	76.5	IEEE	13	76.5	Springer Nature	1	5.9
23	University of Calgary	13	16	81.3	IEEE	13	81.3	IET/IEE	1	6.3
24	Fujitsu Limited	12	13	92.3	IEEE	12	92.3	RELX Group (Elsevier)	1	7.7
25	UNIVERSITY OF ZAGREB	12	14	85.7	IEEE	12	85.7	China Electrochemical Society	1	7.1
26	SPARQ SYSTEMS INC	11	14	78.6	IEEE	11	78.6	IET/IEE	2	14.3
27	Woodward Inc	10	10	100.0	IEEE	10	100.0			
28	Kite Gen Research Srl	9	21	42.9	IEEE	9	42.9	RELX Group (Elsevier)	7	33.3
29	PRENAV INC	9	11	81.8	IEEE	9	81.8	RELX Group (Elsevier)	2	18.2
30	ZOND ENERGY SYSTEMS	9	11	81.8	IEEE	9	81.8	EPE Association	1	9.1
31	US WIND TECHNOLOGY L	8	14	57.1	IEEE	8	57.1	RELX Group (Elsevier)	3	21.4
32	GENEDICS CLEAN ENERG	7	63	11.1	RELX Group (Elsevier)	49	77.8	IEEE	7	11.1
33	Raytheon Co.	7	21	33.3	IEEE	7	33.3	RELX Group (Elsevier)	3	14.3
34	State Grid Corp of China	7	10	70.0	IEEE	7	70.0	China Academic Journal Electronic Publishing House	2	20.0
35	GENEDICS LLC	6	47	12.8	RELX Group (Elsevier)	35	74.5	IEEE	6	12.8
36	Hitachi Ltd	6	11	54.5	IEEE	6	54.5	Hitachi Ltd.	3	27.3
37	Honeywell International Inc.	6	12	50.0	IEEE	6	50.0	AIAA-Am Inst Aero Astro	2	16.7
38	Imperial College	6	13	46.2	IEEE	6	46.2	IEEE/RSJ	2	15.4
39	INVENTUS HOLDINGS LL	6	9	66.7	IEEE	6	66.7	American Automatic Control Council (AACC)	1	11.1

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	LS Electric co. Ltd. (formerly	6	9	66.7	IEEE	6	66.7	IET/IEE	1	11.1
41	Medtronic Inc	6	7	85.7	IEEE	6	85.7	Springer Nature	1	14.3
42	Mitsubishi Heavy Industries	6	57	10.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	28	49.1	ASME-Am Soc Mech Eng	13	22.8
43	OKINAWA INSTITUTE OF	6	28	21.4	RELX Group (Elsevier)	7	25.0	IEEE	6	21.4
44	Alphabet Inc.	5	16	31.3	IEEE	5	31.3	ASME-Am Soc Mech Eng	3	18.8
45	BEIJING GOLDWIND SCIE	5	13	38.5	RELX Group (Elsevier)	6	46.2	IEEE	5	38.5
46	GREEN ENERGY CORP	5	5	100.0	IEEE	5	100.0			
47	NEC Corp	5	6	83.3	IEEE	5	83.3	Institute of Electrical Engineers of Japan	1	16.7
48	RHEINISCH-WESTFALISC	5	5	100.0	IEEE	5	100.0			
49	University of Western Ontari	5	5	100.0	IEEE	5	100.0			
50	Alstom	4	6	66.7	IEEE	4	66.7	A B B Corporate Management Services AG	2	33.3
51	COMBINED ENERGIES LL	4	5	80.0	IEEE	4	80.0	RELX Group (Elsevier)	1	20.0
52	HYPER TECH RESEARCH	4	4	100.0	IEEE	4	100.0			
53	IDENTIFLIGHT INTERNAT	4	6	66.7	IEEE	4	66.7	Massachusetts Institute of Technology	2	33.3
54	KK WIND SOLUTIONS A/S	4	4	100.0	IEEE	4	100.0			
55	NORTHERN POWER SYST	4	5	80.0	IEEE	4	80.0	PennWell Publishing Co.	1	20.0
56	REARDEN POWER LLC	4	4	100.0	IEEE	4	100.0			
57	UNIVERSIDAD PUBLICA	4	5	80.0	IEEE	4	80.0	Instrument Society of America	1	20.0
58	AB SKF	3	3	100.0	IEEE	3	100.0			
59	Baker Hughes Inc.	3	3	100.0	IEEE	3	100.0			
60	Corteva Agriscience(former	3	24	12.5	RELX Group (Elsevier)	7	29.2	Springer Nature	3	12.5
61	Daewoo Shipbuilding & Mari	3	6	50.0	IEEE	3	50.0	IET/IEE	1	16.7
62	Doosan Holding	3	4	75.0	IEEE	3	75.0	IET/IEE	1	25.0
63	EMPIRE MAGNETICS INC	3	3	100.0	IEEE	3	100.0			
64	GLOBAL ENERGYCONCE	3	5	60.0	IEEE	3	60.0	AWEA-American Wind Energy Association	1	20.0
65	HARMONY TURBINES IN	3	5	60.0	IEEE	3	60.0	IOP Publishing	1	20.0
66	International Business Machi	3	15	20.0	RELX Group (Elsevier)	8	53.3	IEEE	3	20.0
67	Intertrust Technologies Corp	3	3	100.0	IEEE	3	100.0			
68	Korea Electric Power Corp	3	8	37.5	RELX Group (Elsevier)	4	50.0	IEEE	3	37.5
69	Microsoft Corporation	3	4	75.0	IEEE	3	75.0	New York Times	1	25.0
70	Nanyang Technological Univ	3	3	100.0	IEEE	3	100.0			
71	SAMAYS INNOVACIONES	3	5	60.0	IEEE	3	60.0	BIRKHAUSER VERLAG AG, VIADUKSTRASSE 40-44, PO	1	20.0
72	Schweitzer Engineering Labo	3	3	100.0	IEEE	3	100.0			
73	University of Florida	3	52	5.8	American Institute of Physics	12	23.1	ACS-Am Chem Soc	9	17.3
74	University of Wisconsin	3	3	100.0	IEEE	3	100.0			
75	ADVANCED MAGNET LA	2	2	100.0	IEEE	2	100.0			
76	Alliance for Sustainable Ener	2	12	16.7	ASME-Am Soc Mech Eng	7	58.3	IEEE	2	16.7
77	Apple Inc	2	2	100.0	IEEE	2	100.0			
78	Bosch (Robert) GmbH	2	2	100.0	IEEE	2	100.0			
79	CHARGEPOINT INC	2	2	100.0	IEEE	2	100.0			
80	Consiglio Nazionale Delle Ri	2	2	100.0	IEEE	2	100.0			

Appendix B: Top 100 Organizations That Cite IEEE; (2002-2021 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	CREATING MOORE LLC	2	4	50.0	IEEE	2	50.0	SAGE Publications Ltd	1	25.0
82	Dana Holding Corp.	2	3	66.7	IEEE	2	66.7	EVS.org	1	33.3
83	HAWAIIAN ELECTRIC CO	2	4	50.0	IEEE	2	50.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2	50.0
84	Kansas State University	2	3	66.7	IEEE	2	66.7	International Research Publication House	1	33.3
85	L3 Harris Technologies (form	2	4	50.0	IEEE	2	50.0	RELX Group (Elsevier)	2	50.0
86	ONSEMBLE LLC	2	4	50.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2	50.0	IEEE	2	50.0
87	Rockwell Automation Inc	2	2	100.0	IEEE	2	100.0			
88	Rolls Royce Holdings Plc	2	7	28.6	ASME-Am Soc Mech Eng	4	57.1	IEEE	2	28.6
89	Trevii - Finanziaria Industrial	2	2	100.0	IEEE	2	100.0			
90	Tsinghua University	2	4	50.0	American Institute of Physics	2	50.0	IEEE	2	50.0
91	Airbus SE	1	6	16.7	RELX Group (Elsevier)	3	50.0	American Institute of Physics	1	16.7
92	American Superconductor Co	1	2	50.0	IEEE	1	50.0	IOP Publishing	1	50.0
93	BASELOAD ENERGY INC	1	2	50.0	Konggansa	1	50.0	IEEE	1	50.0
94	BLUE WATER SHIPPING A	1	1	100.0	IEEE	1	100.0			
95	Boeing Co. (The)	1	14	7.1	NASA-National Aeronautics and Space Admi	5	35.7	AIAA-Am Inst Aero Astro	4	28.6
96	California Institute of Techno	1	6	16.7	RELX Group (Elsevier)	4	66.7	IEEE	1	16.7
97	Cisco Systems Inc.	1	1	100.0	IEEE	1	100.0			
98	CLEAN CURRENT LP	1	3	33.3	IEEE	1	33.3	AIAA-Am Inst Aero Astro	1	33.3
99	DDIS	1	1	100.0	IEEE	1	100.0			
100	DOMETIC SWEDEN AB	1	2	50.0	RELX Group (Elsevier)	1	50.0	IEEE	1	50.0

Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
1	Microsoft Corporation	71347	225566	31.6	IEEE	71347	31.6	ACM-Assoc Comput Mach	60560	26.8
2	International Business Machi	66411	224402	29.6	IEEE	66411	29.6	ACM-Assoc Comput Mach	36647	16.3
3	Apple Inc	47379	142238	33.3	IEEE	47379	33.3	ACM-Assoc Comput Mach	29948	21.1
4	Micron Technology Inc.	43212	131512	32.9	IEEE	43212	32.9	RELX Group (Elsevier)	22049	16.8
5	Qualcomm Inc	41714	119806	34.8	IEEE	41714	34.8	3GPP General Partnership Project Standards Body	27828	23.2
6	AT&T Inc	37836	84515	44.8	IEEE	37836	44.8	ACM-Assoc Comput Mach	5215	6.2
7	Intel Corporation	34882	79119	44.1	IEEE	34882	44.1	3GPP General Partnership Project Standards Body	9985	12.6
8	Broadcom Ltd	29520	49564	59.6	IEEE	29520	59.6	ACM-Assoc Comput Mach	1696	3.4
9	Alphabet Inc.	26668	84031	31.7	IEEE	26668	31.7	ACM-Assoc Comput Mach	15922	18.9
10	Marvell Technology Group Lt	25684	32944	78.0	IEEE	25684	78.0	3GPP General Partnership Project Standards Body	3230	9.8
11	MONOLITHIC 3D INC	18933	33723	56.1	IEEE	18933	56.1	IEEE/JPN Soc App Phys	3445	10.2
12	Semiconductor Energy Labor	18671	263569	7.1	SID-Society for Information Display	89095	33.8	American Institute of Physics	36240	13.7
13	Samsung Electronics Co Ltd	18400	74899	24.6	3GPP General Partnership Project Standards B	21636	28.9	IEEE	18400	24.6
14	Nokia Corporation	17886	53727	33.3	IEEE	17886	33.3	3GPP General Partnership Project Standards Body	13164	24.5
15	Xperi Holding Corporation (F	17648	43968	40.1	IEEE	17648	40.1	ACM-Assoc Comput Mach	3365	7.7
16	Cisco Systems Inc.	17370	61748	28.1	IEEE	17370	28.1	Internet Soc/IETF-Internet Eng Task Force	9904	16.0
17	Massachusetts Institute of Te	14747	62750	23.5	IEEE	14747	23.5	RELX Group (Elsevier)	7664	12.2
18	Ericsson	14402	60781	23.7	3GPP General Partnership Project Standards B	27849	45.8	IEEE	14402	23.7
19	Huawei Technologies Compa	14232	58629	24.3	3GPP General Partnership Project Standards B	27573	47.0	IEEE	14232	24.3
20	InterDigital Inc	13904	68554	20.3	3GPP General Partnership Project Standards B	45704	66.7	IEEE	13904	20.3
21	Sony Group Corp	12923	35224	36.7	IEEE	12923	36.7	3GPP General Partnership Project Standards Body	4269	12.1
22	Siemens Aktiengesellschaft	12474	35962	34.7	IEEE	12474	34.7	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	4387	12.2
23	Western Digital Corp.	12454	25455	48.9	IEEE	12454	48.9	American Institute of Physics	2443	9.6
24	Oracle Corporation	12230	48309	25.3	ACM-Assoc Comput Mach	14002	29.0	IEEE	12230	25.3
25	Medtronic Inc	12008	181126	6.6	RELX Group (Elsevier)	31658	17.5	Wolters Kluwer	23510	13.0
26	Infineon Technologies AG	11191	18446	60.7	IEEE	11191	60.7	American Institute of Physics	1124	6.1
27	ParkerVision Inc	11141	21929	50.8	IEEE	11141	50.8	IET/IEE	5111	23.3
28	Texas Instruments Inc	10349	17216	60.1	IEEE	10349	60.1	International Telecommunication Union	1360	7.9
29	Panasonic Corporation	10263	32992	31.1	IEEE	10263	31.1	3GPP General Partnership Project Standards Body	6545	19.8
30	NXP Semiconductors NV	10219	15953	64.1	IEEE	10219	64.1	American Institute of Physics	958	6.0
31	REARDEN LLC	10205	12877	79.2	IEEE	10205	79.2	3GPP General Partnership Project Standards Body	751	5.8
32	Taiwan Semiconductor Manu	10160	29871	34.0	IEEE	10160	34.0	American Institute of Physics	7830	26.2
33	LG Electronics Inc.	9881	56582	17.5	3GPP General Partnership Project Standards B	34620	61.2	IEEE	9881	17.5
34	Murata Manufacturing Co. Lt	9880	12904	76.6	IEEE	9880	76.6	RELX Group (Elsevier)	455	3.5
35	Advanced Micro Devices Inc	9682	26641	36.3	IEEE	9682	36.3	ACM-Assoc Comput Mach	8325	31.2
36	General Electric Company	9358	35076	26.7	IEEE	9358	26.7	RELX Group (Elsevier)	3857	11.0
37	Personalized Media Commun	9281	56693	16.4	Society of Motion Picture and Television Engi	17095	30.2	IEEE	9281	16.4
38	Fujitsu Limited	8833	25305	34.9	IEEE	8833	34.9	3GPP General Partnership Project Standards Body	3832	15.1
39	Toshiba Corp	8796	21365	41.2	IEEE	8796	41.2	American Institute of Physics	1573	7.4
40	Honeywell International Inc.	8469	24952	33.9	IEEE	8469	33.9	RELX Group (Elsevier)	2681	10.7

Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
41	Rambus Inc.	8399	13148	63.9	IEEE	8399	63.9	IEEE/JPN Soc App Phys	664	5.1
42	Koninklijke Philips N.V.	7811	36329	21.5	IEEE	7811	21.5	RELX Group (Elsevier)	4522	12.4
43	SolarEdge Technologies Inc	7810	9802	79.7	IEEE	7810	79.7	WIP-Renewable Energies	802	8.2
44	STMicroelectronics	7801	13557	57.5	IEEE	7801	57.5	RELX Group (Elsevier)	1040	7.7
45	University of California	7711	67152	11.5	RELX Group (Elsevier)	9373	14.0	ACS-Am Chem Soc	7901	11.8
46	Qorvo	7701	10170	75.7	IEEE	7701	75.7	American Institute of Physics	479	4.7
47	Mass General Brigham (form	7550	123424	6.1	Optical Society of America	40472	32.8	RELX Group (Elsevier)	17937	14.5
48	Macronix International Co. Lt	7542	13984	53.9	IEEE	7542	53.9	IEEE/JPN Soc App Phys	2722	19.5
49	Intuitive Surgical Inc.	7518	19043	39.5	IEEE	7518	39.5	The Medical Image Computing and Computer Assisted Interve	1702	8.9
50	Blackberry Ltd.	7389	29594	25.0	3GPP General Partnership Project Standards B	12452	42.1	IEEE	7389	25.0
51	ZENO SEMICONDUCTOR I	7321	9732	75.2	IEEE	7321	75.2	IEEE/JPN Soc App Phys	1560	16.0
52	NEC Corp	7026	25153	27.9	3GPP General Partnership Project Standards B	8252	32.8	IEEE	7026	27.9
53	Intellectual Ventures Manage	6947	38399	18.1	IEEE	6947	18.1	RELX Group (Elsevier)	3867	10.1
54	HP Inc	6869	21956	31.3	IEEE	6869	31.3	ACM-Assoc Comput Mach	3535	16.1
55	Amazon.com Inc.	6852	24763	27.7	IEEE	6852	27.7	ACM-Assoc Comput Mach	5642	22.8
56	Columbia University	6823	26477	25.8	IEEE	6823	25.8	RELX Group (Elsevier)	2379	9.0
57	Adobe Inc. (former Adobe Sy	6815	18382	37.1	IEEE	6815	37.1	ACM-Assoc Comput Mach	5939	32.3
58	Raytheon Co.	6795	25527	26.6	IEEE	6795	26.6	NASA-National Aeronautics and Space Admin	2106	8.3
59	Tela Innovations inc	6768	21749	31.1	SPIE-Int Soc Opt Engineering	7894	36.3	IEEE	6768	31.1
60	Boston Scientific Corp.	6634	89426	7.4	RELX Group (Elsevier)	23265	26.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	11264	12.6
61	Irobot Corp	6584	12494	52.7	IEEE	6584	52.7	SPIE-Int Soc Opt Engineering	1810	14.5
62	CPG TECHNOLOGIES LLC	6482	12031	53.9	IEEE	6482	53.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1319	11.0
63	Renesas Electronic Corporati	6449	10226	63.1	IEEE	6449	63.1	IEEE/JPN Soc App Phys	544	5.3
64	California Institute of Techno	6289	43519	14.5	IEEE	6289	14.5	RELX Group (Elsevier)	6255	14.4
65	Commscope Holding (formerl	6236	11796	52.9	IEEE	6236	52.9	3GPP General Partnership Project Standards Body	558	4.7
66	Analog Devices Inc.	6223	8916	69.8	IEEE	6223	69.8	RELX Group (Elsevier)	532	6.0
67	Conversant Intellectual Prope	6121	9922	61.7	IEEE	6121	61.7	3GPP General Partnership Project Standards Body	297	3.0
68	Johnson & Johnson	6044	83505	7.2	RELX Group (Elsevier)	18489	22.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	8847	10.6
69	Canon Inc	6021	22278	27.0	IEEE	6021	27.0	RELX Group (Elsevier)	2000	9.0
70	Dexcom Inc	5932	101466	5.8	RELX Group (Elsevier)	25858	25.5	American Diabetes Association	10464	10.3
71	Nippon Telegraph & Telepho	5913	21150	28.0	3GPP General Partnership Project Standards B	6042	28.6	IEEE	5913	28.0
72	Xerox Corp	5877	22086	26.6	IEEE	5877	26.6	ACM-Assoc Comput Mach	3604	16.3
73	HRL Laboratories LLC	5840	13843	42.2	IEEE	5840	42.2	RELX Group (Elsevier)	1083	7.8
74	Fractus SA	5745	10171	56.5	IEEE	5745	56.5	IET/IEE	1366	13.4
75	University of Minnesota (The	5737	14117	40.6	IEEE	5737	40.6	RELX Group (Elsevier)	1497	10.6
76	Cadence Design Systems Inc	5678	13112	43.3	IEEE	5678	43.3	Joint IEEE and ACM	4217	32.2
77	Synopsys Inc.	5531	16046	34.5	IEEE	5531	34.5	SPIE-Int Soc Opt Engineering	3193	19.9
78	Abbott Laboratories	5525	128628	4.3	RELX Group (Elsevier)	29925	23.3	ACS-Am Chem Soc	15233	11.8
79	Industrial Technology Researc	5476	11468	47.8	IEEE	5476	47.8	RELX Group (Elsevier)	1207	10.5
80	University of Illinois	5421	54265	10.0	American Institute of Physics	8726	16.1	ACS-Am Chem Soc	8054	14.8

Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Ricoh Co. Ltd.	5251	12562	41.8	IEEE	5251	41.8	ACM-Assoc Comput Mach	1884	15.0
82	Electronics and Telecommuni	5131	11645	44.1	IEEE	5131	44.1	3GPP General Partnership Project Standards Body	1497	12.9
83	Mitsubishi Electric Corp	5073	12276	41.3	IEEE	5073	41.3	3GPP General Partnership Project Standards Body	1914	15.6
84	Commvault Systems Inc.	5022	8305	60.5	IEEE	5022	60.5	ACM-Assoc Comput Mach	1346	16.2
85	Dolby Laboratories Inc	4899	13593	36.0	IEEE	4899	36.0	International Telecommunication Union	2001	14.7
86	Motorola Solutions Inc.	4873	10301	47.3	IEEE	4873	47.3	American Institute of Physics	940	9.1
87	Witricity Corp	4813	9164	52.5	IEEE	4813	52.5	American Institute of Physics	757	8.3
88	Thermo Fisher Scientific Inc	4778	34711	13.8	RELX Group (Elsevier)	10371	29.9	IEEE	4778	13.8
89	Magna International Inc.	4690	9191	51.0	IEEE	4690	51.0	SAE-Society of Automobile Engineers	825	9.0
90	Fraunhofer Gesellschaft	4674	11505	40.6	IEEE	4674	40.6	Audio Eng Soc	794	6.9
91	Applied Materials Inc.	4649	18962	24.5	IEEE	4649	24.5	American Institute of Physics	3446	18.2
92	Digimarc Corp.	4645	11992	38.7	IEEE	4645	38.7	SPIE-Int Soc Opt Engineering	1555	13.0
93	Adaptix	4627	6848	67.6	IEEE	4627	67.6	European Telecom Standards Institute (ETSI)	777	11.3
94	Hitachi Ltd	4601	16879	27.3	IEEE	4601	27.3	ACM-Assoc Comput Mach	1246	7.4
95	The Arizona Board of Regent	4592	20935	21.9	IEEE	4592	21.9	RELX Group (Elsevier)	2603	12.4
96	Wolfspeed Inc. (formerly Cre	4544	12445	36.5	IEEE	4544	36.5	American Institute of Physics	2627	21.1
97	NVIDIA Corp.	4524	11865	38.1	IEEE	4524	38.1	ACM-Assoc Comput Mach	2510	21.2
98	RPX Corp	4399	11017	39.9	IEEE	4399	39.9	Internet Soc/IETF-Internet Eng Task Force	910	8.3
99	L3 Harris Technologies (form	4305	7610	56.6	IEEE	4305	56.6	RELX Group (Elsevier)	376	4.9
100	Boeing Co. (The)	4223	14426	29.3	IEEE	4223	29.3	RELX Group (Elsevier)	1725	12.0
101	Immersion Corp.	4129	11722	35.2	IEEE	4129	35.2	ACM-Assoc Comput Mach	1238	10.6
102	Sap SE	4128	18341	22.5	ACM-Assoc Comput Mach	6208	33.8	IEEE	4128	22.5
103	Technicolor SA	4122	8865	46.5	IEEE	4122	46.5	SPIE-Int Soc Opt Engineering	462	5.2
104	Hon Hai Precision Industry C	4095	25360	16.1	3GPP General Partnership Project Standards B	8415	33.2	IEEE	4095	16.1
105	OneTrust	3910	13323	29.3	ACM-Assoc Comput Mach	6865	51.5	IEEE	3910	29.3
106	On Semiconductor Corporati	3847	5390	71.4	IEEE	3847	71.4	RELX Group (Elsevier)	333	6.2
107	Comcast Corp	3771	33203	11.4	3GPP General Partnership Project Standards B	26204	78.9	IEEE	3771	11.4
108	Lockheed Martin Corp.	3528	25168	14.0	IEEE	3528	14.0	RELX Group (Elsevier)	3400	13.5
109	Dell Technologies Inc	3525	10571	33.3	IEEE	3525	33.3	ACM-Assoc Comput Mach	2155	20.4
110	ABB Ltd	3446	5420	63.6	IEEE	3446	63.6	RELX Group (Elsevier)	263	4.9
111	Commissariat A L'Energie At	3336	12935	25.8	IEEE	3336	25.8	RELX Group (Elsevier)	2472	19.1
112	Corning Inc.	3300	12496	26.4	IEEE	3300	26.4	RELX Group (Elsevier)	1624	13.0
113	Hewlett Packard Enterprises	3288	9812	33.5	IEEE	3288	33.5	ACM-Assoc Comput Mach	1979	20.2
114	INDIVIDUAL PATENTER	3274	21293	15.4	IEEE	3274	15.4	RELX Group (Elsevier)	3207	15.1
115	Stanford University	3165	38736	8.2	RELX Group (Elsevier)	5225	13.5	Springer Nature	4955	12.8
116	Sanken Electric Co. Ltd.	3150	4221	74.6	IEEE	3150	74.6	RELX Group (Elsevier)	675	16.0
117	Cirrus Logic Inc.	3023	3913	77.3	IEEE	3023	77.3	Acoustical Society of America	123	3.1
118	United States Navy	3005	10905	27.6	IEEE	3005	27.6	RELX Group (Elsevier)	1229	11.3
119	Verizon Communications Inc	2981	9245	32.2	IEEE	2981	32.2	Internet Soc/IETF-Internet Eng Task Force	1656	17.9
120	Softbank Corp	2945	6905	42.7	IEEE	2945	42.7	ACM-Assoc Comput Mach	659	9.5

Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
121	Chipbond Technology Corp	2928	3665	79.9	IEEE	2928	79.9	RELX Group (Elsevier)	270	7.4
122	Tabula Inc	2903	7806	37.2	IEEE	2903	37.2	ACM-Assoc Comput Mach	2878	36.9
123	Meta Platforms Inc.(formerly	2895	11392	25.4	IEEE	2895	25.4	ACM-Assoc Comput Mach	2751	24.1
124	Global Foundries Inc	2883	6569	43.9	IEEE	2883	43.9	American Institute of Physics	581	8.8
125	University of Washington	2859	18581	15.4	RELX Group (Elsevier)	2876	15.5	IEEE	2859	15.4
126	MicroUnity Systems Enginee	2808	4595	61.1	IEEE	2808	61.1	Joint IEEE and ACM	407	8.9
127	Sonos Inc	2776	7083	39.2	IEEE	2776	39.2	SPIE-Int Soc Opt Engineering	871	12.3
128	Seagate Technology Plc	2672	7233	36.9	IEEE	2672	36.9	American Institute of Physics	1350	18.7
129	Microchip Technology Inc.	2656	4174	63.6	IEEE	2656	63.6	ACM-Assoc Comput Mach	192	4.6
130	Bosch (Robert) GmbH	2579	10692	24.1	IEEE	2579	24.1	RELX Group (Elsevier)	1022	9.6
131	Silicon Laboratories Inc	2566	3294	77.9	IEEE	2566	77.9	RELX Group (Elsevier)	141	4.3
132	PDF Solutions	2546	4024	63.3	IEEE	2546	63.3	SPIE-Int Soc Opt Engineering	908	22.6
133	ASM International N.V.	2530	25824	9.8	American Institute of Physics	4665	18.1	RELX Group (Elsevier)	4576	17.7
134	University of Michigan	2524	18151	13.9	RELX Group (Elsevier)	3242	17.9	IEEE	2524	13.9
135	University of Texas	2510	19101	13.1	RELX Group (Elsevier)	3087	16.2	IEEE	2510	13.1
136	Juniper Networks Inc.	2507	8682	28.9	IEEE	2507	28.9	Network Working Group RFC	2325	26.8
137	Rockwell Automation Inc	2489	3552	70.1	IEEE	2489	70.1	RELX Group (Elsevier)	188	5.3
138	FireEye Inc	2437	6906	35.3	IEEE	2437	35.3	ACM-Assoc Comput Mach	1253	18.1
139	II-VI Inc	2435	6677	36.5	IEEE	2435	36.5	IET/IEE	849	12.7
140	IP RESERVOIR LLC	2429	4729	51.4	IEEE	2429	51.4	ACM-Assoc Comput Mach	800	16.9
141	SIPCO LLC	2372	4182	56.7	IEEE	2372	56.7	Internet Soc/IETF-Internet Eng Task Force	339	8.1
142	Amberwave Inc	2337	6843	34.2	IEEE	2337	34.2	American Institute of Physics	2045	29.9
143	Mediatek Inc.	2320	5819	39.9	IEEE	2320	39.9	3GPP General Partnership Project Standards Body	1526	26.2
144	Seiko Epson Corporation	2304	6727	34.3	IEEE	2304	34.3	RELX Group (Elsevier)	488	7.3
145	Honda Motor Co. Ltd.(Honda	2294	5852	39.2	IEEE	2294	39.2	RELX Group (Elsevier)	818	14.0
146	Masimo Corp	2285	4845	47.2	IEEE	2285	47.2	RELX Group (Elsevier)	402	8.3
147	ATTOPSEMI TECHNOLOG	2277	2831	80.4	IEEE	2277	80.4	IEEE/JPN Soc App Phys	345	12.2
148	Empire Technology Develop	2256	7527	30.0	IEEE	2256	30.0	Joint IEEE and ACM	1018	13.5
149	Georgia Institute of Technolo	2237	7423	30.1	IEEE	2237	30.1	RELX Group (Elsevier)	930	12.5
150	SUN PATENT TRUST	2213	12992	17.0	International Telecommunication Union	4600	35.4	3GPP General Partnership Project Standards Body	4341	33.4
151	Cubic Corporation	2207	3162	69.8	IEEE	2207	69.8	The International Society of Infrared, Millimeter, and Terahert	162	5.1
152	Accenture Ltd.	2137	6582	32.5	IEEE	2137	32.5	ACM-Assoc Comput Mach	1192	18.1
153	Toyota Motor Corp	2083	6971	29.9	IEEE	2083	29.9	RELX Group (Elsevier)	1258	18.0
154	INTOUCH HEALTH INC	2067	5286	39.1	IEEE	2067	39.1	Springer Nature	339	6.4
155	Lenovo Group Ltd	2067	6891	30.0	3GPP General Partnership Project Standards B	3268	47.4	IEEE	2067	30.0
156	BT Group PLC	2062	4838	42.6	IEEE	2062	42.6	ACM-Assoc Comput Mach	377	7.8
157	Viasat	2050	3257	62.9	IEEE	2050	62.9	AIAA-Am Inst Aero Astro	211	6.5
158	Cortica Ltd	2046	2980	68.7	IEEE	2046	68.7	ACM-Assoc Comput Mach	344	11.5
159	Cognex Corp.	2042	4758	42.9	IEEE	2042	42.9	RELX Group (Elsevier)	800	16.8
160	Innovative Silicon SA	2033	2515	80.8	IEEE	2033	80.8	RELX Group (Elsevier)	108	4.3

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161	PACT XPP TECHNOLOGIE	2018	3472	58.1	IEEE	2018	58.1	ACM-Assoc Comput Mach	327	9.4
162	Battelle Memorial Institute	1998	8917	22.4	IEEE	1998	22.4	RELX Group (Elsevier)	1710	19.2
163	Texas A&M University	1998	4222	47.3	IEEE	1998	47.3	RELX Group (Elsevier)	394	9.3
164	Quarterhill Inc	1971	3739	52.7	IEEE	1971	52.7	3GPP General Partnership Project Standards Body	589	15.8
165	Fujifilm Business Innovation	1963	8690	22.6	IEEE	1963	22.6	ACM-Assoc Comput Mach	1337	15.4
166	Walt Disney Co.	1958	7632	25.7	ACM-Assoc Comput Mach	3353	43.9	IEEE	1958	25.7
167	Interuniversity MicroElectron	1944	4730	41.1	IEEE	1944	41.1	American Institute of Physics	444	9.4
168	TDK Corporation	1940	6026	32.2	IEEE	1940	32.2	American Institute of Physics	1070	17.8
169	Align Technology Inc	1912	17481	10.9	JCO - Journal of Clinical Orthodontics	2816	16.1	RELX Group (Elsevier)	2071	11.8
170	Kandou	1908	2102	90.8	IEEE	1908	90.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	82	3.9
171	Emerson Electric Co.	1905	7446	25.6	IEEE	1905	25.6	RELX Group (Elsevier)	969	13.0
172	Flex Ltd (Formerly Flextronic	1894	2667	71.0	IEEE	1894	71.0	CBS Interactive	321	12.0
173	Netapp Inc	1877	10358	18.1	ACM-Assoc Comput Mach	4206	40.6	IEEE	1877	18.1
174	Energous Corporation	1867	2429	76.9	IEEE	1867	76.9	The European Association on Antennas and Propagation (Eur	196	8.1
175	Lumens Technologies Inc. (fo	1858	6089	30.5	IEEE	1858	30.5	ACM-Assoc Comput Mach	1099	18.0
176	University of South Florida	1837	6962	26.4	IEEE	1837	26.4	RELX Group (Elsevier)	1165	16.7
177	Stryker Corp.	1823	16201	11.3	RELX Group (Elsevier)	2977	18.4	Springer Nature	1918	11.8
178	T-Mobile USA INC	1818	6981	26.0	IEEE	1818	26.0	3GPP General Partnership Project Standards Body	824	11.8
179	FormFactor Inc	1799	3540	50.8	IEEE	1799	50.8	Springer Nature	648	18.3
180	Vanderbilt University	1742	8170	21.3	IEEE	1742	21.3	RELX Group (Elsevier)	1162	14.2
181	Magic Leap Inc	1740	5183	33.6	IEEE	1740	33.6	ACM-Assoc Comput Mach	563	10.9
182	VMWare Inc	1731	11449	15.1	ACM-Assoc Comput Mach	5170	45.2	IEEE	1731	15.1
183	Citrix Systems Inc	1730	5230	33.1	IEEE	1730	33.1	ACM-Assoc Comput Mach	906	17.3
184	NXGEN PARTNERS IP LLC	1718	4010	42.8	IEEE	1718	42.8	Optical Society of America	1132	28.2
185	Ignis Innovation Inc	1691	2447	69.1	IEEE	1691	69.1	SID-Society for Information Display	444	18.1
186	Wisteria Trading Inc	1687	3455	48.8	IEEE	1687	48.8	SPIE-Int Soc Opt Engineering	405	11.7
187	BAE Systems Plc.	1677	3112	53.9	IEEE	1677	53.9	SPIE-Int Soc Opt Engineering	183	5.9
188	Mevion Medical Systems Inc	1677	5293	31.7	IEEE	1677	31.7	RELX Group (Elsevier)	1027	19.4
189	Infinera Corporation	1675	3576	46.8	IEEE	1675	46.8	Optical Society of America	447	12.5
190	University of Southern Califo	1645	9278	17.7	IEEE	1645	17.7	ACS-Am Chem Soc	1234	13.3
191	SRI International	1640	4896	33.5	IEEE	1640	33.5	RELX Group (Elsevier)	435	8.9
192	Northrop Grumman Corp	1578	3714	42.5	IEEE	1578	42.5	American Institute of Physics	261	7.0
193	Purdue University	1577	12161	13.0	RELX Group (Elsevier)	1971	16.2	ACS-Am Chem Soc	1750	14.4
194	University of North Carolina	1555	10204	15.2	IEEE	1555	15.2	RELX Group (Elsevier)	1282	12.6
195	GENGHISCOMM HOLDIN	1525	1876	81.3	IEEE	1525	81.3	3GPP General Partnership Project Standards Body	79	4.2
196	GUIDED THERAPY SYSTE	1522	6383	23.8	IEEE	1522	23.8	RELX Group (Elsevier)	1064	16.7
197	University of Wisconsin	1522	10951	13.9	IEEE	1522	13.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1400	12.8
198	Brain Corporation	1513	4361	34.7	IEEE	1513	34.7	MIT Press	571	13.1
199	Illumina Inc.	1497	7967	18.8	IEEE	1497	18.8	RELX Group (Elsevier)	947	11.9
200	Nielsen Holdings Plc	1474	11400	12.9	RELX Group (Elsevier)	2119	18.6	IEEE	1474	12.9

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201	Intertrust Technologies Corp	1466	9407	15.6	ACM-Assoc Comput Mach	1673	17.8	IEEE	1466	15.6
202	Enphase Energy Inc	1456	1609	90.5	IEEE	1456	90.5	IET/IEEE	48	3.0
203	Transphorm Inc	1434	2994	47.9	IEEE	1434	47.9	American Institute of Physics	511	17.1
204	Orange	1403	2919	48.1	IEEE	1403	48.1	3GPP General Partnership Project Standards Body	253	8.7
205	United States of America Dep	1401	9481	14.8	RELX Group (Elsevier)	1833	19.3	IEEE	1401	14.8
206	Hong Kong University of Sci	1391	3556	39.1	IEEE	1391	39.1	American Institute of Physics	320	9.0
207	eBay Inc	1381	7157	19.3	IEEE	1381	19.3	ACM-Assoc Comput Mach	1029	14.4
208	SK Hynix Inc	1381	2406	57.4	IEEE	1381	57.4	American Institute of Physics	135	5.6
209	CONSTELLATION DESIGN	1377	1631	84.4	IEEE	1377	84.4	IET/IEEE	46	2.8
210	ORIGIN WIRELESS INC	1373	2045	67.1	IEEE	1373	67.1	American Physical Society	129	6.3
211	Ford Motor Co.	1355	3829	35.4	IEEE	1355	35.4	SAE-Society of Automobile Engineers	426	11.1
212	Palantir Technologies Inc	1338	6453	20.7	ACM-Assoc Comput Mach	1351	20.9	IEEE	1338	20.7
213	Zebra Technologies Corp.	1336	2665	50.1	IEEE	1336	50.1	ACM-Assoc Comput Mach	161	6.0
214	Headwater Partners 1 LLC	1334	3157	42.3	IEEE	1334	42.3	3GPP General Partnership Project Standards Body	616	19.5
215	University of Florida	1334	6087	21.9	IEEE	1334	21.9	RELX Group (Elsevier)	969	15.9
216	LibertyMedia	1333	2513	53.0	IEEE	1333	53.0	ACM-Assoc Comput Mach	208	8.3
217	Thales	1325	3173	41.8	IEEE	1325	41.8	ACM-Assoc Comput Mach	210	6.6
218	Schneider Electric S.A.	1315	6689	19.7	IEEE	1315	19.7	RELX Group (Elsevier)	693	10.4
219	Norton Lifelock (formerly Sy	1303	4919	26.5	IEEE	1303	26.5	ACM-Assoc Comput Mach	1145	23.3
220	United Microelectronics Corp	1285	2665	48.2	IEEE	1285	48.2	American Institute of Physics	371	13.9
221	QST Holdings Llc	1280	2202	58.1	IEEE	1280	58.1	Joint IEEE and ACM	241	10.9
222	Synaptics Inc.	1252	2425	51.6	IEEE	1252	51.6	ACM-Assoc Comput Mach	144	5.9
223	GoPro Inc	1249	2556	48.9	IEEE	1249	48.9	ACM-Assoc Comput Mach	230	9.0
224	Extreme Networks Inc	1244	2784	44.7	IEEE	1244	44.7	Network Working Group RFC	318	11.4
225	United States Army	1242	5706	21.8	IEEE	1242	21.8	RELX Group (Elsevier)	553	9.7
226	Avaya Inc	1210	4526	26.7	IEEE	1210	26.7	Internet Soc/IETF-Internet Eng Task Force	795	17.6
227	PHOENIX SOLUTIONS INC	1206	3656	33.0	IEEE	1206	33.0	ISCA (International Speech Communication Association)	478	13.1
228	P4TENTS1 LLC	1199	2759	43.5	IEEE	1199	43.5	ACM-Assoc Comput Mach	372	13.5
229	BUTTERFLY NETWORKS I	1191	1316	90.5	IEEE	1191	90.5	RELX Group (Elsevier)	34	2.6
230	NETWORK-1 TECHNOLOG	1191	3430	34.7	IEEE	1191	34.7	ACM-Assoc Comput Mach	735	21.4
231	Smith & Nephew Plc.	1187	16954	7.0	RELX Group (Elsevier)	3370	19.9	Wolters Kluwer	1633	9.6
232	Velatia Group	1182	1535	77.0	IEEE	1182	77.0	Echelon Corp	113	7.4
233	Johns Hopkins University	1175	9040	13.0	RELX Group (Elsevier)	1643	18.2	IEEE	1175	13.0
234	Math Works Inc (The)	1168	2854	40.9	IEEE	1168	40.9	ACM-Assoc Comput Mach	560	19.6
235	University of Nebraska	1166	5835	20.0	IEEE	1166	20.0	Springer Nature	851	14.6
236	Agency for Science Technolo	1159	4123	28.1	IEEE	1159	28.1	RELX Group (Elsevier)	576	14.0
237	General Motors Corp	1157	3402	34.0	IEEE	1157	34.0	RELX Group (Elsevier)	558	16.4
238	LivaNova Plc	1155	21486	5.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	4796	22.3	RELX Group (Elsevier)	4289	20.0
239	Kyocera Corp.	1148	4544	25.3	3GPP General Partnership Project Standards B	2144	47.2	IEEE	1148	25.3
240	Cornell University	1141	9687	11.8	RELX Group (Elsevier)	1456	15.0	IEEE	1141	11.8

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241	Washington University in St.	1138	8839	12.9	RELX Group (Elsevier)	1202	13.6	IEEE	1138	12.9
242	National Instruments Corp.	1121	2163	51.8	IEEE	1121	51.8	3GPP General Partnership Project Standards Body	179	8.3
243	X ONE INC	1114	3082	36.1	IEEE	1114	36.1	ACM-Assoc Comput Mach	554	18.0
244	Michigan State University	1100	11451	9.6	Optical Society of America	2140	18.7	American Institute of Physics	1561	13.6
245	Carnegie Mellon University	1088	4642	23.4	IEEE	1088	23.4	RELX Group (Elsevier)	535	11.5
246	Crossbar Inc	1086	4184	26.0	IEEE	1086	26.0	RELX Group (Elsevier)	565	13.5
247	Agilent Technologies Inc	1084	4175	26.0	IEEE	1084	26.0	RELX Group (Elsevier)	552	13.2
248	III HOLDINGS 1 LLC	1080	1931	55.9	IEEE	1080	55.9	ACM-Assoc Comput Mach	238	12.3
249	Teledyne Technologies Incor	1071	2876	37.2	IEEE	1071	37.2	SPIE-Int Soc Opt Engineering	350	12.2
250	REALTIME DATA LLC	1068	4169	25.6	IEEE	1068	25.6	Network Working Group RFC	546	13.1
251	SalesforceCom Inc	1063	3843	27.7	IEEE	1063	27.7	ACM-Assoc Comput Mach	596	15.5
252	Verance Corp	1061	2126	49.9	IEEE	1061	49.9	SPIE-Int Soc Opt Engineering	285	13.4
253	KLA-Tencor Corp.	1049	7672	13.7	SPIE-Int Soc Opt Engineering	2221	28.9	American Institute of Physics	1066	13.9
254	University of Pennsylvania	1049	10510	10.0	RELX Group (Elsevier)	1559	14.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1147	10.9
255	Eastman Kodak Company	1045	4700	22.2	IEEE	1045	22.2	RELX Group (Elsevier)	464	9.9
256	IDC Llc	1040	2900	35.9	IEEE	1040	35.9	SID-Society for Information Display	391	13.5
257	New Jersey Institute of Techn	1035	3005	34.4	IEEE	1035	34.4	RELX Group (Elsevier)	685	22.8
258	Northwestern University	1034	18626	5.6	ACS-Am Chem Soc	4453	23.9	RELX Group (Elsevier)	2387	12.8
259	Skyworks Solutions Inc	1031	1409	73.2	IEEE	1031	73.2	Summit Technical Media	53	3.8
260	Sunpower Corp	1025	1417	72.3	IEEE	1025	72.3	RELX Group (Elsevier)	103	7.3
261	Schlumberger Ltd.	1013	15939	6.4	Society of Petroleum Engineers	3542	22.2	Society of Exploration Geophysicists	2441	15.3
262	Valencell Inc	1004	2708	37.1	IEEE	1004	37.1	RELX Group (Elsevier)	267	9.9
263	Fortinet Inc	999	1881	53.1	IEEE	999	53.1	ACM-Assoc Comput Mach	245	13.0
264	Duke University	993	8036	12.4	RELX Group (Elsevier)	1059	13.2	IEEE	993	12.4
265	McAfee Inc	988	4393	22.5	IEEE	988	22.5	ACM-Assoc Comput Mach	823	18.7
266	Ecole Polytechnique Federale	982	4062	24.2	IEEE	982	24.2	RELX Group (Elsevier)	482	11.9
267	Nantero Inc	975	12386	7.9	ACS-Am Chem Soc	3753	30.3	American Institute of Physics	2434	19.7
268	SRC Computers Inc.	974	1104	88.2	IEEE	974	88.2	ACM-Assoc Comput Mach	40	3.6
269	3M Co	965	26744	3.6	RELX Group (Elsevier)	3825	14.3	Wolters Kluwer	2835	10.6
270	AMPT LLC	962	1242	77.5	IEEE	962	77.5	RELX Group (Elsevier)	82	6.6
271	Charles Stark Draper Laborat	961	3656	26.3	IEEE	961	26.3	RELX Group (Elsevier)	460	12.6
272	Harvard University	956	20508	4.7	Springer Nature	2822	13.8	RELX Group (Elsevier)	2733	13.3
273	TRILLIANT NETWORKS IN	948	1416	66.9	IEEE	948	66.9	Internet Soc/IETF-Internet Eng Task Force	98	6.9
274	Otto Bock Holding GmbH &	941	2818	33.4	IEEE	941	33.4	RELX Group (Elsevier)	589	20.9
275	TuSimple	914	1185	77.1	IEEE	914	77.1	European Conference on Computer Vision-Google/Microsoft	66	5.6
276	Johnson Controls Internationa	913	2570	35.5	IEEE	913	35.5	RELX Group (Elsevier)	490	19.1
277	Nikon Corp.	910	5357	17.0	SPIE-Int Soc Opt Engineering	2191	40.9	IEEE	910	17.0
278	Cleveland Clinic (and Founda	906	5445	16.6	RELX Group (Elsevier)	1085	19.9	IEEE	906	16.6
279	YFY Inc	906	10883	8.3	SID-Society for Information Display	4195	38.5	National Symposium on Information Display	1030	9.5
280	Technion - Israel Institute of	900	3091	29.1	IEEE	900	29.1	RELX Group (Elsevier)	425	13.7

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281	Maxlinear Inc	897	1159	77.4	IEEE	897	77.4	ACM-Assoc Comput Mach	47	4.1
282	AMS AG	893	4507	19.8	American Institute of Physics	986	21.9	IEEE	893	19.8
283	BIOSENSORS INTERNATI	888	2994	29.7	IEEE	888	29.7	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	427	14.3
284	SYNQOR INC	886	1013	87.5	IEEE	886	87.5	Penton/IPC, Inc.	45	4.4
285	Synergy Microwave Corp	880	1072	82.1	IEEE	880	82.1	Horizon House Publications	66	6.2
286	State University of New York	874	4909	17.8	IEEE	874	17.8	RELX Group (Elsevier)	755	15.4
287	Lam Research Corp.	861	5794	14.9	American Institute of Physics	1449	25.0	IEEE	861	14.9
288	University System of Maryla	861	6635	13.0	RELX Group (Elsevier)	1152	17.4	IEEE	861	13.0
289	State Farm Mutual Automobi	857	2825	30.3	IEEE	857	30.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	198	7.0
290	Baxter International Inc.	853	9592	8.9	RELX Group (Elsevier)	2069	21.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	959	10.0
291	Midtronics Inc.	852	2065	41.3	IEEE	852	41.3	RELX Group (Elsevier)	371	18.0
292	Princeton University	850	7412	11.5	American Institute of Physics	1470	19.8	IEEE	850	11.5
293	VIVAQUANT LLC	846	1714	49.4	IEEE	846	49.4	RELX Group (Elsevier)	206	12.0
294	University of Alabama	845	4172	20.3	RELX Group (Elsevier)	853	20.4	IEEE	845	20.3
295	HTC Corporation	835	4236	19.7	3GPP General Partnership Project Standards B	2596	61.3	IEEE	835	19.7
296	Voxer Llc	825	1445	57.1	IEEE	825	57.1	Internet Soc/IETF-Internet Eng Task Force	132	9.1
297	Airbus SE	824	2083	39.6	IEEE	824	39.6	RELX Group (Elsevier)	270	13.0
298	Schweitzer Engineering Labo	814	1055	77.2	IEEE	814	77.2	ACM-Assoc Comput Mach	42	4.0
299	Yahoo Inc	813	5725	14.2	ACM-Assoc Comput Mach	1779	31.1	IEEE	813	14.2
300	Virginia Tech University	811	4312	18.8	RELX Group (Elsevier)	815	18.9	IEEE	811	18.8
301	Global Tel Link Corp	802	1574	51.0	IEEE	802	51.0	Springer Nature	97	6.2
302	Ciena Corp	797	2537	31.4	IEEE	797	31.4	Optical Society of America	409	16.1
303	ZTE Microelectronics Techno	793	4512	17.6	3GPP General Partnership Project Standards B	2515	55.7	IEEE	793	17.6
304	Sotera Wireless	792	1722	46.0	IEEE	792	46.0	Springer Nature	337	19.6
305	Knowles Corp	781	1632	47.9	IEEE	781	47.9	RELX Group (Elsevier)	186	11.4
306	ASML Holding NV	780	15910	4.9	SPIE-Int Soc Opt Engineering	5763	36.2	American Institute of Physics	3032	19.1
307	Tel Aviv University	779	5189	15.0	RELX Group (Elsevier)	842	16.2	IEEE	779	15.0
308	JPMorgan	775	6582	11.8	Source Media	1197	18.2	IEEE	775	11.8
309	New York University	773	4947	15.6	IEEE	773	15.6	RELX Group (Elsevier)	583	11.8
310	VerintSys	771	5595	13.8	International Data Group	1414	25.3	ACM-Assoc Comput Mach	1067	19.1
311	Imagination Technologies Gr	768	1901	40.4	IEEE	768	40.4	ACM-Assoc Comput Mach	486	25.6
312	Korea Advanced Institute for	767	2755	27.8	IEEE	767	27.8	RELX Group (Elsevier)	356	12.9
313	Power Integrations Inc.	767	1181	64.9	IEEE	767	64.9	American Institute of Physics	63	5.3
314	Wave Computing Inc.	767	2542	30.2	IEEE	767	30.2	ACM-Assoc Comput Mach	487	19.2
315	Centre National De La Reche	766	7435	10.3	RELX Group (Elsevier)	1859	25.0	IEEE	766	10.3
316	PixelWorks Inc	765	1206	63.4	IEEE	765	63.4	SPIE-Int Soc Opt Engineering	113	9.4
317	PME IP PTY LTD	764	1950	39.2	IEEE	764	39.2	ACM-Assoc Comput Mach	485	24.9
318	Aisin Corporation (Aisin Seki	752	5485	13.7	Optical Society of America	2015	36.7	IEEE	752	13.7
319	MOJO MOBILITY INC	749	979	76.5	IEEE	749	76.5	RELX Group (Elsevier)	81	8.3
320	M/A-COM Technology Solut	745	1551	48.0	IEEE	745	48.0	American Institute of Physics	194	12.5

Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
321	Ohio State University	742	3864	19.2	IEEE	742	19.2	RELX Group (Elsevier)	636	16.5
322	Yageo Corporation	742	1093	67.9	IEEE	742	67.9	IET/IEE	201	18.4
323	Round Rock Research LLC	737	2261	32.6	IEEE	737	32.6	RELX Group (Elsevier)	356	15.7
324	Vicor Corp	733	940	78.0	IEEE	733	78.0	Penton/IPC, Inc.	44	4.7
325	BANDSPEED INC	732	1291	56.7	IEEE	732	56.7	Bluetooth Special Interest Group	447	34.6
326	Ossur hf	732	2344	31.2	IEEE	732	31.2	RELX Group (Elsevier)	520	22.2
327	Advantest Corp.	728	1042	69.9	IEEE	728	69.9	American Institute of Physics	41	3.9
328	Eagleview Technologies Inc	727	3070	23.7	IEEE	727	23.7	ACM-Assoc Comput Mach	517	16.8
329	NUMENTA INC	714	2967	24.1	Numenta Inc.	1075	36.2	IEEE	714	24.1
330	Viavi Solutions Inc	712	2479	28.7	IEEE	712	28.7	Optical Society of America	266	10.7
331	SAS Institute	709	2821	25.1	IEEE	709	25.1	RELX Group (Elsevier)	420	14.9
332	Soraa Inc	705	8621	8.2	American Institute of Physics	2519	29.2	Institute of Pure and Applied Physics	1766	20.5
333	PURE Storage Inc	704	5473	12.9	Internet Soc/IETF-Internet Eng Task Force	2874	52.5	ACM-Assoc Comput Mach	1259	23.0
334	North Carolina State Universi	703	4479	15.7	RELX Group (Elsevier)	708	15.8	IEEE	703	15.7
335	AOL Inc	699	3570	19.6	ACM-Assoc Comput Mach	805	22.5	IEEE	699	19.6
336	Maui Diagnostic Imaging	698	1111	62.8	IEEE	698	62.8	RELX Group (Elsevier)	125	11.3
337	FACENSE LTD	692	1113	62.2	IEEE	692	62.2	RELX Group (Elsevier)	105	9.4
338	University of Pittsburgh	691	5991	11.5	RELX Group (Elsevier)	1327	22.1	IEEE	691	11.5
339	National Chiao Tung Univers	689	1405	49.0	IEEE	689	49.0	American Institute of Physics	120	8.5
340	Silverbrook Pty Ltd	685	1946	35.2	IEEE	685	35.2	Springer Nature	447	23.0
341	Nant Holdings IP Llc	682	3054	22.3	Joint IEEE and ACM	878	28.7	ACM-Assoc Comput Mach	693	22.7
342	FARO Technologies Inc.	677	1932	35.0	IEEE	677	35.0	SPIE-Int Soc Opt Engineering	371	19.2
343	University of Virginia (and P	676	3303	20.5	IEEE	676	20.5	RELX Group (Elsevier)	462	14.0
344	City University of Hong Kon	672	2267	29.6	IEEE	672	29.6	RELX Group (Elsevier)	234	10.3
345	Otsuka Holdings Co Ltd	671	4587	14.6	RELX Group (Elsevier)	932	20.3	IEEE	671	14.6
346	MegaChips Corp	670	1012	66.2	IEEE	670	66.2	American Physical Society	69	6.8
347	Realtek Semiconductor Corp.	668	806	82.9	IEEE	668	82.9	IET/IEE	18	2.2
348	Here Global BV	665	1436	46.3	IEEE	665	46.3	ACM-Assoc Comput Mach	174	12.1
349	OVONYX MEMORY TECH	658	889	74.0	IEEE	658	74.0	IEEE/JPN Soc App Phys	65	7.3
350	Becton Dickinson and Co.	655	31959	2.0	Wolters Kluwer	8030	25.1	RELX Group (Elsevier)	5218	16.3
351	THE FLORIDA INTERNATI	652	2149	30.3	IEEE	652	30.3	RELX Group (Elsevier)	339	15.8
352	IDEMIA	649	1624	40.0	IEEE	649	40.0	RELX Group (Elsevier)	157	9.7
353	Avid Technology Inc.	648	1531	42.3	IEEE	648	42.3	ACM-Assoc Comput Mach	575	37.6
354	Baidu Inc	648	1417	45.7	IEEE	648	45.7	International Machine Learning Society (IMLS)	117	8.3
355	Dassault Systemes SA	642	4346	14.8	RELX Group (Elsevier)	940	21.6	IEEE	642	14.8
356	Denso Corp	640	1410	45.4	IEEE	640	45.4	RELX Group (Elsevier)	114	8.1
357	HEMOSONICS LLC	639	1721	37.1	IEEE	639	37.1	RELX Group (Elsevier)	267	15.5
358	Halliburton Co. (Holding)	637	9984	6.4	Society of Petroleum Engineers	3566	35.7	RELX Group (Elsevier)	798	8.0
359	Unisantis Electronics Ltd	636	783	81.2	IEEE	636	81.2	Institute of Pure and Applied Physics	50	6.4
360	ACORN TECHNOLOGIES I	627	2123	29.5	IEEE	627	29.5	American Institute of Physics	525	24.7

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
361	EAGLE HARBOR HOLDIN	623	1141	54.6	IEEE	623	54.6	SAE-Society of Automobile Engineers	162	14.2
362	Fastback Networks Inc	623	908	68.6	IEEE	623	68.6	IET/IEE	65	7.2
363	General Dynamics Corp	623	1516	41.1	IEEE	623	41.1	American Physical Society	248	16.4
364	Aerospace Corp.	621	1670	37.2	IEEE	621	37.2	RELX Group (Elsevier)	243	14.6
365	Sulvolta Inc	620	1301	47.7	IEEE	620	47.7	American Institute of Physics	200	15.4
366	EXEGY INC	619	1202	51.5	IEEE	619	51.5	ACM-Assoc Comput Mach	201	16.7
367	Micro Focus International PL	619	1887	32.8	IEEE	619	32.8	ACM-Assoc Comput Mach	424	22.5
368	PLUSN LLC	619	853	72.6	IEEE	619	72.6	IET/IEE	78	9.1
369	The National Aeronautical an	603	3395	17.8	IEEE	603	17.8	RELX Group (Elsevier)	383	11.3
370	F5 Networks Inc	599	3619	16.6	IEEE	599	16.6	ACM-Assoc Comput Mach	573	15.8
371	University of Notre Dame Du	599	1495	40.1	IEEE	599	40.1	RELX Group (Elsevier)	135	9.0
372	Open Text Corp	591	1913	30.9	IEEE	591	30.9	ACM-Assoc Comput Mach	384	20.1
373	EDGE 3 TECHNOLOGIES I	588	939	62.6	IEEE	588	62.6	RELX Group (Elsevier)	56	6.0
374	MULTI-TECH SYSTEMS IN	588	908	64.8	IEEE	588	64.8	ACM-Assoc Comput Mach	44	4.8
375	VirnetX Holding Corp	586	11780	5.0	Network Working Group RFC	6287	53.4	Internet Soc/IETF-Internet Eng Task Force	1810	15.4
376	Tencent Holding Ltd	582	1861	31.3	IEEE	582	31.3	International Telecommunication Union	525	28.2
377	Soitec SA	578	2251	25.7	IEEE	578	25.7	American Institute of Physics	530	23.5
378	EchoStar Corp	575	1226	46.9	IEEE	575	46.9	ACM-Assoc Comput Mach	71	5.8
379	MACAU UNIVERSITY OF	572	832	68.8	IEEE	572	68.8	RELX Group (Elsevier)	66	7.9
380	Nintendo Co. Ltd.	567	3386	16.7	ACM-Assoc Comput Mach	760	22.4	IEEE	567	16.7
381	Eaton Corp.	565	849	66.5	IEEE	565	66.5	RELX Group (Elsevier)	58	6.8
382	Sumitomo Electric Industries	563	3640	15.5	IEEE	563	15.5	American Institute of Physics	446	12.3
383	Seoul National University	560	2009	27.9	IEEE	560	27.9	ACS-Am Chem Soc	209	10.4
384	University of Utah	557	4107	13.6	RELX Group (Elsevier)	638	15.5	IEEE	557	13.6
385	ECOLE DE TECHBOLOGIE	556	866	64.2	IEEE	556	64.2	3GPP General Partnership Project Standards Body	66	7.6
386	Autodesk Inc.	554	4536	12.2	ACM-Assoc Comput Mach	2786	61.4	IEEE	554	12.2
387	Tigo Energy Inc	553	864	64.0	IEEE	553	64.0	WIP-Renewable Energies	233	27.0
388	Pennsylvania State University	552	3739	14.8	RELX Group (Elsevier)	683	18.3	IEEE	552	14.8
389	Carl-Zeiss Stiftung	549	10717	5.1	Optical Society of America	1953	18.2	SPIE-Int Soc Opt Engineering	1897	17.7
390	Virgin Islands Microsystems	549	2251	24.4	IEEE	549	24.4	American Institute of Physics	461	20.5
391	Comtech Telecommunication	548	1213	45.2	IEEE	548	45.2	3GPP General Partnership Project Standards Body	300	24.7
392	Vestas Wind Systems A/S	548	1161	47.2	IEEE	548	47.2	AWEA-American Wind Energy Association	98	8.4
393	Continental AG (Germany Fe	547	1030	53.1	IEEE	547	53.1	RELX Group (Elsevier)	72	7.0
394	Screen Holdings Co Ltd (For	547	2052	26.7	IEEE	547	26.7	RELX Group (Elsevier)	308	15.0
395	ARTILUX INC	544	1050	51.8	IEEE	544	51.8	Optical Society of America	177	16.9
396	Assa Abloy AB	543	3267	16.6	IEEE	543	16.6	International Association for Cryptologic Research (IACR)	403	12.3
397	University of Central Florida	540	4414	12.2	RELX Group (Elsevier)	628	14.2	IEEE	540	12.2
398	Teradyne Inc.	539	1055	51.1	IEEE	539	51.1	ASME-Am Soc Mech Eng	123	11.7
399	3D Systems Corp.	538	1253	42.9	IEEE	538	42.9	ACM-Assoc Comput Mach	300	23.9
400	Omnivision Technologies Inc	537	1341	40.0	IEEE	537	40.0	Optical Society of America	309	23.0

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401	OMNI MEDSCI INC	532	7534	7.1	Optical Society of America	2613	34.7	RELX Group (Elsevier)	1176	15.6
402	United States Air Force	530	2082	25.5	IEEE	530	25.5	RELX Group (Elsevier)	204	9.8
403	University of Connecticut	530	2988	17.7	IEEE	530	17.7	RELX Group (Elsevier)	503	16.8
404	National Taiwan University	529	1211	43.7	IEEE	529	43.7	American Institute of Physics	104	8.6
405	University of Colorado (The	522	5265	9.9	Optical Society of America	1243	23.6	RELX Group (Elsevier)	720	13.7
406	MC10 Inc	520	6359	8.2	American Institute of Physics	1079	17.0	ACS-Am Chem Soc	996	15.7
407	Via Technologies Inc.	517	1171	44.2	IEEE	517	44.2	Joint IEEE and ACM	163	13.9
408	Pulse Link Inc	516	630	81.9	IEEE	516	81.9	Scientific American Inc.	24	3.8
409	Asahi Kasei Corp.	514	7791	6.6	RELX Group (Elsevier)	1829	23.5	Wolters Kluwer	1157	14.9
410	NEWRACOM Inc	514	522	98.5	IEEE	514	98.5	SPIE-Int Soc Opt Engineering	4	0.8
411	AB Initio Technology LLC	512	1782	28.7	ACM-Assoc Comput Mach	560	31.4	IEEE	512	28.7
412	Emcore Corp.	512	1146	44.7	IEEE	512	44.7	American Institute of Physics	163	14.2
413	Xtera Communications Inc.	511	1520	33.6	IEEE	511	33.6	IET/IEE	356	23.4
414	Case Western Reserve Univer	509	2349	21.7	IEEE	509	21.7	RELX Group (Elsevier)	303	12.9
415	Hoya Corp	508	1687	30.1	IEEE	508	30.1	American Institute of Physics	333	19.7
416	HeartFlow Inc	506	5236	9.7	Springer Nature	1153	22.0	RELX Group (Elsevier)	1086	20.7
417	CREATIVE KINGDOMS LL	505	1685	30.0	IEEE	505	30.0	ACM-Assoc Comput Mach	457	27.1
418	STRONG FORCE IOT PORT	502	630	79.7	IEEE	502	79.7	RELX Group (Elsevier)	53	8.4
419	ZENA TECHNOLOGIES IN	502	2249	22.3	IEEE	502	22.3	ACS-Am Chem Soc	466	20.7
420	ST-Ericsson SA (Patents split	498	721	69.1	IEEE	498	69.1	3GPP General Partnership Project Standards Body	90	12.5
421	Alibaba Group Holding Ltd	497	1178	42.2	IEEE	497	42.2	ACM-Assoc Comput Mach	166	14.1
422	CENTRIPETAL NETWORK	496	1421	34.9	IEEE	496	34.9	ACM-Assoc Comput Mach	267	18.8
423	Tokyo Electron Limited	496	3800	13.1	American Institute of Physics	541	14.2	RELX Group (Elsevier)	524	13.8
424	A10 Networks Inc	494	945	52.3	IEEE	494	52.3	ACM-Assoc Comput Mach	111	11.7
425	UT-Battelle LLC	494	4853	10.2	RELX Group (Elsevier)	915	18.9	ACS-Am Chem Soc	576	11.9
426	Keysight Technologies	492	1190	41.3	IEEE	492	41.3	3GPP General Partnership Project Standards Body	249	20.9
427	Roche Holding Ltd.	492	10329	4.8	RELX Group (Elsevier)	2095	20.3	ACS-Am Chem Soc	1321	12.8
428	Fortive Corporation	490	1262	38.8	IEEE	490	38.8	RELX Group (Elsevier)	169	13.4
429	Khalifa University of Science	489	789	62.0	IEEE	489	62.0	RELX Group (Elsevier)	46	5.8
430	Olympus Corp.	489	2330	21.0	IEEE	489	21.0	RELX Group (Elsevier)	267	11.5
431	Yonsei University	487	1316	37.0	IEEE	487	37.0	RELX Group (Elsevier)	118	9.0
432	Swiss Federal Institute of Tec	486	2006	24.2	ACM-Assoc Comput Mach	531	26.5	IEEE	486	24.2
433	CapitalOne	484	2033	23.8	IEEE	484	23.8	ACM-Assoc Comput Mach	185	9.1
434	National University of Ireland	483	1031	46.8	IEEE	483	46.8	RELX Group (Elsevier)	82	8.0
435	Qinetiq Group Ltd	480	1546	31.0	IEEE	480	31.0	American Institute of Physics	167	10.8
436	BLUERISC INC	479	1336	35.9	IEEE	479	35.9	ACM-Assoc Comput Mach	297	22.2
437	Medispectra Inc	479	1279	37.5	IEEE	479	37.5	RELX Group (Elsevier)	145	11.3
438	Cheetah Omni LLC	478	1876	25.5	IEEE	478	25.5	Optical Society of America	445	23.7
439	Drexel University	478	4738	10.1	RELX Group (Elsevier)	1101	23.2	American Institute of Physics	746	15.7
440	NEWVALUEXCHANGE LT	478	1279	37.4	IEEE	478	37.4	ACM-Assoc Comput Mach	297	23.2

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441	MIRAMAR LABS INC	476	1353	35.2	IEEE	476	35.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	166	12.3
442	University of Massachusetts	474	3958	12.0	ACS-Am Chem Soc	523	13.2	RELX Group (Elsevier)	483	12.2
443	Commonwealth Scientific an	471	1184	39.8	IEEE	471	39.8	RELX Group (Elsevier)	149	12.6
444	University of Tennessee Rese	471	2395	19.7	IEEE	471	19.7	RELX Group (Elsevier)	430	18.0
445	Advanced New Technologies	468	846	55.3	IEEE	468	55.3	ACM-Assoc Comput Mach	76	9.0
446	Hexagon AB	468	1260	37.1	IEEE	468	37.1	ACM-Assoc Comput Mach	134	10.6
447	NUCURRENT INC	468	588	79.6	IEEE	468	79.6	Wireless Power Consortium	32	5.4
448	Alstom	466	766	60.8	IEEE	466	60.8	ASME-Am Soc Mech Eng	55	7.2
449	Tellabs Inc.	465	1033	45.0	IEEE	465	45.0	Internet Soc/IETF-Internet Eng Task Force	172	16.7
450	Lumentum Holdings Inc	464	1657	28.0	IEEE	464	28.0	Optical Society of America	409	24.7
451	Duchossois Group Inc	463	1317	35.2	IEEE	463	35.2	International Association for Cryptologic Research (IACR)	169	12.8
452	MicroStrategy Inc.	463	1914	24.2	IEEE	463	24.2	United Business Media/UBM Tech	374	19.5
453	SiOnyx Inc	463	2883	16.1	American Institute of Physics	806	28.0	IEEE	463	16.1
454	INNOPHASE INC	460	506	90.9	IEEE	460	90.9	European Microwave Association	23	4.5
455	Telecom Italia SPA	458	1165	39.3	IEEE	458	39.3	3GPP General Partnership Project Standards Body	167	14.3
456	University of Rochester	458	3251	14.1	IEEE	458	14.1	Optical Society of America	396	12.2
457	SK Telecom Co. Ltd.	457	816	56.0	IEEE	457	56.0	3GPP General Partnership Project Standards Body	123	15.1
458	William Marsh Rice Universi	454	4388	10.3	ACS-Am Chem Soc	842	19.2	RELX Group (Elsevier)	578	13.2
459	Ligado Networks (formerly Li	453	847	53.5	IEEE	453	53.5	Baltzer Science Publishers B.V.	131	15.5
460	Uber Technologies Inc	449	1014	44.3	IEEE	449	44.3	ACM-Assoc Comput Mach	99	9.8
461	ALOFT MEDIA LLC	448	686	65.3	IEEE	448	65.3	3GPP General Partnership Project Standards Body	105	15.3
462	Oewaves Inc	447	1434	31.2	Optical Society of America	551	38.4	IEEE	447	31.2
463	SolAero Technologies Corp	444	873	50.9	IEEE	444	50.9	RELX Group (Elsevier)	135	15.5
464	Ostendo Technologies Inc	443	1851	23.9	IEEE	443	23.9	ACM-Assoc Comput Mach	220	11.9
465	TRACBEAM LLC	443	969	45.7	IEEE	443	45.7	ACM-Assoc Comput Mach	122	12.6
466	Catholic University Leuven	441	1593	27.7	IEEE	441	27.7	ACS-Am Chem Soc	174	10.9
467	University of New Mexico	441	2866	15.4	IEEE	441	15.4	RELX Group (Elsevier)	323	11.3
468	Walmart Stores Inc	440	1415	31.1	IEEE	440	31.1	ACM-Assoc Comput Mach	127	9.0
469	Twitter Inc	437	848	51.5	IEEE	437	51.5	ACM-Assoc Comput Mach	120	14.2
470	Lattice Semiconductor Corp.	433	634	68.3	IEEE	433	68.3	Joint IEEE and ACM	40	6.3
471	Oki Electric Industry Co. Ltd.	432	1069	40.4	IEEE	432	40.4	IEICE-Inst Elec Info Comm Eng	126	11.8
472	United Services Automobile	432	3690	11.7	Source Media	634	17.2	IEEE	432	11.7
473	ICOSYSTEM CORP	429	580	74.0	IEEE	429	74.0	RELX Group (Elsevier)	27	4.7
474	ISCO International Llc	429	519	82.7	IEEE	429	82.7	3GPP General Partnership Project Standards Body	85	16.4
475	Experian Plc	427	3917	10.9	IEEE	427	10.9	Source Media	413	10.5
476	Conduent Inc	426	1241	34.3	IEEE	426	34.3	ACM-Assoc Comput Mach	132	10.6
477	Bank of America Corp.	425	1293	32.9	IEEE	425	32.9	ACM-Assoc Comput Mach	215	16.6
478	King Abdullah University of	424	2651	16.0	IEEE	424	16.0	ACS-Am Chem Soc	420	15.8
479	Kofax Inc	422	1204	35.0	IEEE	422	35.0	ACM-Assoc Comput Mach	197	16.4
480	Palo Alto Networks	421	1057	39.8	IEEE	421	39.8	ACM-Assoc Comput Mach	152	14.4

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rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
481	Ceva Inc.	419	870	48.2	IEEE	419	48.2	ACM-Assoc Comput Mach	117	13.4
482	IPCO LLC	417	732	57.0	IEEE	417	57.0	ACM-Assoc Comput Mach	54	7.4
483	King Fahd University of Petr	417	1693	24.6	RELX Group (Elsevier)	479	28.3	IEEE	417	24.6
484	Snap Inc	416	1103	37.7	IEEE	416	37.7	ACM-Assoc Comput Mach	247	22.4
485	Visa Inc	415	1819	22.8	IEEE	415	22.8	ACM-Assoc Comput Mach	139	7.6
486	Densbits Technologies Ltd	414	767	54.0	IEEE	414	54.0	Springer Nature	119	15.5
487	Nanyang Technological Univ	412	4963	8.3	ACS-Am Chem Soc	1012	20.4	RELX Group (Elsevier)	888	17.9
488	UNIVERSITY OF MACAU	411	607	67.7	IEEE	411	67.7	Royal Society of Chemistry	44	7.2
489	Conformis Inc	409	13898	2.9	Springer Nature	2221	16.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1888	13.6
490	Danaher Corp.	409	6243	6.6	RELX Group (Elsevier)	1039	16.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	532	8.5
491	ACACIA MEDIA TECHNO	408	738	55.3	IEEE	408	55.3	ACM-Assoc Comput Mach	66	8.9
492	Deutsche Telekom AG	408	1215	33.6	IEEE	408	33.6	3GPP General Partnership Project Standards Body	164	13.5
493	Saudi Arabian Oil Company (406	6944	5.8	RELX Group (Elsevier)	1484	21.4	Society of Petroleum Engineers	986	14.2
494	ROCKLEY PHOTONICS LT	404	1301	31.1	Optical Society of America	411	31.6	IEEE	404	31.1
495	SAIC Inc	403	2525	16.0	SPIE-Int Soc Opt Engineering	564	22.3	IEEE	403	16.0
496	Tufts University	402	6505	6.2	RELX Group (Elsevier)	1147	17.6	ACS-Am Chem Soc	1051	16.2
497	Furukawa Electric Co. Ltd.	401	2117	18.9	Optical Society of America	519	24.5	IEEE	401	18.9
498	Nio Co. Ltd	398	763	52.2	IEEE	398	52.2	CBS Interactive	50	6.6
499	PerkinElmer Inc.	398	4903	8.1	ACS-Am Chem Soc	944	19.3	RELX Group (Elsevier)	718	14.6
500	Rohde & Schwarz GmbH &	398	836	47.6	IEEE	398	47.6	ATSC Std	211	25.2