

Growth and Trends of Power Electronics Research Literature (2001-2010)

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Abstract

This paper deals with the scientometric analysis on Power Electronics. The data is taken from the IEL database by using the keyword "Power Electronics" for search. The data were extracted from the IEL database for the period of 10 years from 2001 to 2010. This study was based of 109661 articles. The paper illustrates authorship pattern, growth of publications, source-wise distribution, authorship affiliation, title-wise distribution etc.

Keywords: Bibliometrics, Power Elelctronics, Scientometrics

1. INTRODUCTION

Scientometrics is the science of measuring and analyzing the science. Scientometric techniques are being used for a variety of purpose like determination of various scientific indicators, evaluation of scientific output, selection of journals for libraries and even forecasting the potential of a particular field [1&2].

Power Electronics is the art of converting electrical energy from one form to another in an efficient, clean, compact, and robust manner for convenient utilization [3]. Power Electronics involves the study of

- i Power semiconductor devices - their physics, characteristics, drive requirements and their protection for optimum utilisation of their capacities,
- ii Power converter topologies involving them,
- iii Control strategies of the converters,
- iv Digital, analogue and microelectronics involved,
- v Capacitive and magnetic energy storage elements,
- vi Rotating and static electrical devices,
- vii Quality of waveforms generated, and
- viii Electro Magnetic and Radio Frequency Interference

2. OBJECTIVES

The main objectives of the present study are:

- i To examine the growth of Power Electronics during 2001-2010;
- ii To identify and analyze the Institution-wise distribution;
- iii To measure the source of the publications;
- iv Publisher-wise distribution; and
- v Author wise distribution.

3. SCOPE AND METHODOLOGY

The data were extracted from the IEL database for the period 10 years from 2001 to 2010. The data were taken from the database by using the keyword "Power Electronics" for search. There are totally 1,09,661 article published during the above period. The paper published in the conferences and journals only have been considered for this scientometric analysis. The collected data has been classified by using MS Access.

Table 1 Growth of Publications

Year	Total	%
2001	6334	5.77
2002	6796	6.20
2003	7049	6.43
2004	9610	8.76
2005	9174	8.37
2006	12167	11.09
2007	12037	10.98
2008	12398	11.31
2009	15321	13.97
2010	18772	17.12
	109661	100

Table 1 shows the growth of publications in Power Electronics. It is evident that during the period 2001 - 2010, a total of 1,09,661 articles were published at the International level. There is an increasing trend in terms of number of publications. The year 2010 has recorded highest number of articles 18772 (17.12%) followed by 15321 (13.97%). The growth of publications in is depicted in Figure 1.

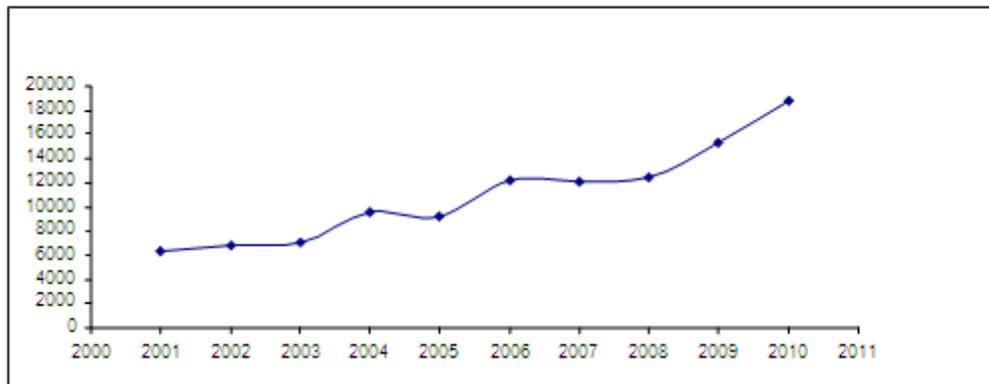


Fig.1 Growth of publications in power electronics

Table 2 Relative Growth Rate on Publication of the Journal

Year	Total	%	Growth Rate
2001	6334	5.77	-
2002	6796	6.20	0.80
2003	7049	6.43	0.41
2004	9610	8.76	3.50
2005	9174	8.37	-0.50
2006	12167	11.09	3.18
2007	12037	10.98	-0.11
2008	12398	11.31	0.33
2009	15321	13.97	2.37
2010	18772	17.12	2.28
	109661	100	1.226

$$\text{Growth rate formula} = \frac{Y_2 - Y_1}{Y_1 \times 100}$$

Table 2 explains the relative growth rate of journal is in its peak in the year 2004 and is very less in the year 2008. In all the other years, the growth rate is steady ranging from 2.0 to 3.0 %. The mean relative growth rate was found to be 1.226. The average growth rate has positive value showing the increasing trend in the contribution on the power electronics journal. Further, if the same trend continues, the research out put on power electronics journal may double in every 5 years.

Table 3 Distribution of Articles by Bibliographic Form

S.No.	Type of Content	No. of Publications	%
1	Conference	70522	64.31
2	Journals	38267	34.90
3	Books	64	0.06
4	Standards	71	0.06
5	Educational Courses	14	0.01
6	Early Access	723	0.66
		109661	100

Table 3 shows that maximum number of articles ie 70,522 nos. (64.31%) are published in the Conference proceedings. The journal articles are 38,267 nos.(34.90%). It is found that only the IEEE Conference publications are in more number than IEEE Journals. Early access publications are only 0.66%. That is the articles have been accepted for publication in a future issue of the journal, but has not been fully edited. Content may be changed prior to final publications.

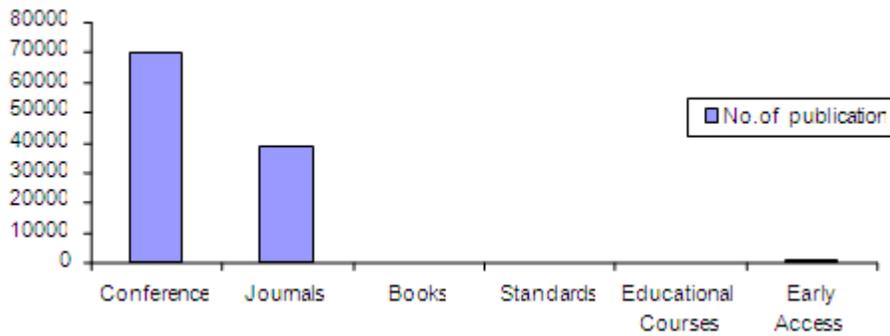


Fig. 2 Distribution of articles by bibliographic form

Table 4 Publisher-wise Distribution of Articles

S.No.	Name of the Publisher	No. of Publications	%
1	IEEE	84899	77.42
2	IET	12678	11.56
3	AIP	11555	10.54
4	AVS	490	0.45
5	IBM	39	0.03
		109661	100

Table 4 reveals that maximum number of articles ie, 84899 Nos. (77.42%) are published by IEEE Publisher, followed by 12678 Nos.(11.56%) published by IET Publisher. AIP publisher have published 11555 articles (10.54%), and AVS Publisher have published 490 articles (0.45%). Only 39 articles (0.30%) are published by IBM Publisher.

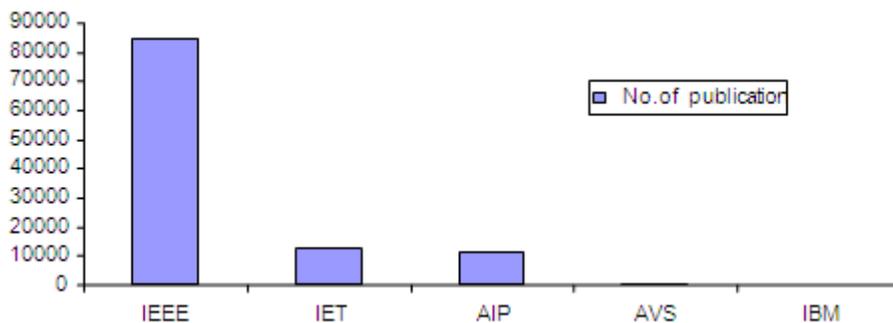


Fig. 3 Publisher-wise distribution of articles

Table 5 Ranking of Authors

S.No.	Author	No. of Publications	S.No	Author	No. of Publication
1	Lee, F.C	269	14	Zhang,J	95
2	Blaabjerg,F	264	15	Hung,A.Q	89
3	Nakaoka,M	219	16	Garcia,O	81
4	Boroyevich,D	173	17	Rodriguez, P	77
5	Ohnishi,K	147	18	Wang,X	74
6	Al-Haddad,K	143	19	Jovanovic, M.M	72
7	Cobos, J.A	121	20	Oliver, J. A	56
8	Teodorescu,R	118	21	Tunnemann,A	46
9	Singh,B	117	22	Zhihua Wang	43
10	Emadi,A	116	23	Kim,T	34
11	Wang,F	115	24	Matsuo, H	28
12	Edwards,C	112	25	Kuo-Hsing Cheng	28
13	Ninomiya,T	100		Total	2737

Table 5 shows the top 25 authors with more number of contributions. Lee. F.C with 269 articles rank top in the list. He is followed by Blaabjerg, F in second position

with 264 articles and followed by Nakaoka, M with 219 articles. The Indian author Singh. B is in the 9th position of the table with 117 articles.

Table 6 Institution - wise Distribution of Publications

S.No.	Name of the Institution	Records
1	Coll. of Electr. Eng., Zhejiang Univ., Hangzhou, China	159
2	Coll. of Electr. Eng., Zhejiang Univ., Hangzhou	123
3	Sch. of Electr. & Electron. Eng., Nanyang Technol. Univ. Singapore	122
4	Sch. of Electr. & Comput. Eng., Georgia Inst. of Technol., Atlanta, GA, USA	121
5	Dept. of Electr. Eng., Nat. Taiwan Univ., Taipei, Taiwan	112
6	Dept. of Electr. Eng., Tsinghua Univ., Beijing, China	98
7	Sch. of Electr. & Comput. Eng., Georgia Inst. of Technol., Atlanta, GA, USA	92
8	Bradley Dept. of Electr. & Comput. Eng., Virginia Polytech. Inst. & State Univ., Blacksburg, VA	92
9	Dept. of Electr. Eng., Nat. Cheng Kung Univ., Tainan, Taiwan	90
10	School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore	88
11	Sch. of Electr. & Electron. Eng., Nanyang Technol. Univ.,	83
12	Bradley Dept. of Electr. & Comput. Eng., Virginia Polytech. Inst. & State Univ., Blacksburg, VA. USA	79
13	Huazhong Univ. of Sci. & Technol., Wuhan	79

14	Dept. of Electr. Eng., Nat. Taiwan Univ., Taipei	76
15	Dept. of Electr. Eng., Nat. Cheng Kung Univ., Tainan	74
16	Dept. of Electr. Eng., Texas A&M Univ., College Station, TX, USA	71
17	Nanyang Technol. Univ., Singapore	70
18	Sch. of Electr. & Electron. Eng., Nanyang Technol. Univ.	54
19	Dept. of Electr. & Comput. Eng., North Carolina State Univ., Raleigh, NC, USA	53
20	NTT Photonics Labs., NTT Corp., Atsugi, Japan	50
21	Inst. of Microelectron., Singapore	42
22	Nat. Chiao Tung Univ., Hsinchu	40
23	Dept. of Electr. Eng. & Comput. Sci., Korea Adv. Inst. of Sci. & Technol., Daejeon	36
24	CINVESTAV-IPN, Mexico City	20
25	Sch. of Electr. Eng. & Autom., Harbin Inst. of Technol., Harbin, China	20

Table 6 indicates Institution-wise research productivity among top 25 institutes in the world. It is noted that College of Electrical Engineering, Zhejiang University, Hangzhou, China ranks first in order by contributing 159 of total research output during the study

period. College of Electrical Engineering, Zhejiang University, Hangzhou secured second place with 123 records, School of Electrical & Electronics Engineering, Nanyang Technology, Singapore secured third position.

Table 7 Number of Publications of the Most Productive Periodicals

S.No.	Name of the Institution	Records
1	Coll. of Electr. Eng., Zhejiang Univ., Hangzhou, China	159
2	Coll. of Electr. Eng., Zhejiang Univ., Hangzhou	123
3	Sch. of Electr. & Electron. Eng., Nanyang Technol. Univ. Singapore	122
4	Sch. of Electr. & Comput. Eng., Georgia Inst. of Technol., Atlanta, GA, USA	121
5	Dept. of Electr. Eng., Nat. Taiwan Univ., Taipei, Taiwan	112
6	Dept. of Electr. Eng., Tsinghua Univ., Beijing, China	98
7	Sch. of Electr. & Comput. Eng., Georgia Inst. of Technol., Atlanta, GA, USA	92
8	Bradley Dept. of Electr. & Comput. Eng., Virginia Polytech. Inst. & State Univ., Blacksburg, VA	92
9	Dept. of Electr. Eng., Nat. Cheng Kung Univ., Tainan, Taiwan	90
10	School of Electrical and Electronic Engineering, Nanyang Technological University, Singapore	88
11	Sch. of Electr. & Electron. Eng., Nanyang Technol. Univ.,	83
12	Bradley Dept. of Electr. & Comput. Eng., Virginia Polytech. Inst. & State Univ., Blacksburg, VA, USA	79

13	Huazhong Univ. of Sci. & Technol., Wuhan	79
14	Dept. of Electr. Eng., Nat. Taiwan Univ., Taipei	76
15	Dept. of Electr. Eng., Nat. Cheng Kung Univ., Tainan	74
16	Dept. of Electr. Eng., Texas A&M Univ., College Station, TX, USA	71
17	Nanyang Technol. Univ., Singapore	70
18	Sch. of Electr. & Electron. Eng., Nanyang Technol. Univ.	54
19	Dept. of Electr. & Comput. Eng., North Carolina State Univ., Raleigh, NC, USA	53
20	NTT Photonics Labs., NTT Corp., Atsugi, Japan	50
21	Inst. of Microelectron., Singapore	42
22	Nat. Chiao Tung Univ., Hsinchu	40
23	Dept. of Electr. Eng. & Comput. Sci., Korea Adv. Inst. of Sci. & Technol., Daejeon	36
24	CINVESTAV-IPN, Mexico City	20
25	Sch. of Electr. Eng. & Autom., Harbin Inst. of Technol., Harbin, China	20

The articles on power electronics were published in various periodicals. The Table 7 tabulates the top 25 periodicals that published the articles on power electronics.

The Electronics Letters published 10,255 articles and it is ranked number one in the table. The Applied Physics letters published 5976 articles on power electronics during the study period and it is ranked second.

4. CONCLUSION

The number of articles published during the period 2001-2010 were found to be 1,09,661. During the first five years of study period the growth in the publication of the articles on the selected topic shows a marginal growth. There had been a significant number of articles published after 2005. The Indian author Singh.B is ranked ninth position in the ranking of authors. The articles on power electronics were published in high numbers in conference proceedings. Among the various publishers the IEEE placed in the top list with large number of publications.

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