

Scientometric Portrait of Professor M. Lakshmanan: A Study based on Scopus Online Database

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Abstract

Professor M. Lakshmanan has been one of the most versatile research workers in the field of Nonlinear Dynamics today at the international level (15 countries) and has contributed to the field extensively. Particularly very few people have contributed to both the fields of Solitons and Chaos, which are major constituents of Nonlinear Dynamics, on equal footing as Prof. Lakshmanan has done. Further, Dr. Lakshmanan has single handedly built an active research group of international standard in Nonlinear Dynamics and established a Centre for Nonlinear Dynamics at Bharathidasan University, Tiruchirappalli, India. However, there are hardly any sources through which other outputs of these collaborations with 70 Institutions and it could be easily documented and studied. Scientometrics is an application of quantitative techniques for documenting, collecting works of eminent scientists and researchers. In this study present a concise sketch of Professor M. Lakshmanan on his scientific achievements and his research has made great impact in Nonlinear Dynamics. The channels of communications used and distribution of publications among the channels were found with indicators. He has 291 Publications to his credit and received 5014 citations with 38 h-index during the period of 1972-2016. The results indicate his secular publication productivity and nature of research activities were such that he eminently qualified to be taken as a role model for the young generation to emulate in the field of Nonlinear Dynamics.

Keywords: Scientometric Portrait; Citations; h-index; Highly Cited Papers;

1. INTRODUCTION

The terms bibliometrics by Pritchard and 'Naukometriya' (the Russian for 'Scientometrics') by Nalimov & Mulchenko were coined simultaneously in 1969 while Narin (1976) used the term 'Evaluative bibliometrics' to denote the use of bibliometric techniques, especially publication and citation analysis in the assessment of a scientific creativity. Bibliometrics is not only the term that is used to refer to the quantitative study of document-related processes. Scientometrics, is fields that overlap with bibliometrics to greater or lesser extent (in the sense either that similar methods are used, or that related processes are studied);

Kalyane and Kalyane (1993) for the first time used the phrase 'Scientometric Portrait' to carry out bio-bibliometric studies on scientists while Sinha & Bhatnagar (1980) and Sinha & Ullah (1994) used the term 'Information profile' for such studies while Sen (1995) proposed the term 'Microbibliometrics' for the studies on individual scientists in IASLIC conference (1994). Recently the term 'Bio-bibliometrics' is being used for a

method of retrieving and visualizing biological information (Stapley & Benoit, 2000) while Koganurmuth, et al. (2003) have suggested that 'Scientometric portrait' is the appropriate phrase for the studies on scientists.

2. BIOGRAPHICAL SKETCH

M Lakshmanan earned his BSc from NGM College, Pollachi and MSc from Madras Christian College. He carried out his doctoral research in nonlinear dynamics at the Department of Theoretical Physics, University of Madras (1970-74) under the supervision of PM Mathews. He then spent a year at the University of Tuebingen, as an Alexander von Humboldt Foundation post-doctoral Fellow and another year at Eindhoven University. He was a Royal Society Nuffield Foundation Fellow at University of Manchester, Institute of Science and Technology (1979-80); Visiting Guest Scientist, University of Uppasala (1981); and JSPS Fellow at Kyoto University (1984-85). He has also held several short-term Visiting positions in many countries from time to time. Lakshmanan joined the Department of Physics, Bharathidasan University (then Autonomous

Postgraduate Centre of University of Madras), Tiruchirapalli (1978) as a Reader He became Professor (1984) and served as Head of the Department of Physics (1992-2006), when he was made Professor of Eminence.

2.1 Academic and Research Achievements

Lakshmanan has intensive research activities in nonlinear dynamics and theoretical physics including the fields of solitons, integrable systems, bifurcations and chaos and their applications. His identification of magnetic solitons in ferromagnetic systems, invention of the simplest dissipative chaotic circuit along with Murali and Chua (MLC circuit) and his demonstration on the energy sharing collision of optical solitons in multimode fibres, and many other novel results, have enriched the subject and made a mark in the field. A thriving school of young research workers under his leadership started working on different areas of non-linear dynamics. He has published more than 315 research articles with 5060 Citations indexed in Web of Science databases and 291 publication with 5014 citations index in Scopus database and wrote/edited several books on non-linear dynamics. He has mentored 25 Ph.Ds and many MPhil and MSc students.

He served as an INSA Council Member (2005-07). He has also served/is serving as a Member of the Editorial Boards of several prestigious journals, such as Proceedings of Royal Society of London A, International Journal of Bifurcation and Chaos, Chaos Solitons and Fractals, Journal of Nonlinear Mathematical Physics, and Advances in Mathematical Physics.

2.2 Awards and Honours

Lakshmanan received SS Bhatnagar Prize (1989), Hari Om Trust Meghnad Saha Award of UGC (1990), Tamil Nadu Scientists Award (1994), N Biren Roy Memorial Lecture Award of INSA (1998), Goyal Prize (2005), VV Narlikar Memorial Lecture Award of INSA (2006), Raja Ramanna Fellowship of DAE (2006), DST Ramanna Fellowship (2007) and AC Banerjee Lecture Award by NASI (2007). He is a Fellow of the Indian Academy of Sciences, Bangalore and National Academy of Sciences (India), Allahabad, and is an elected Foreign Member of Royal Academy of Sciences, Uppsala, Sweden.

3. OBJECTIVES OF THE STUDY

The prime purpose of the study is to document quantitatively the publication productivity pattern of Dr. M. Lakshmanan from Bharathidasan University:

- i. Year-wise and domain-wise productivity
- ii. To analyze the authorships and collaborative pattern
- iii. To identify the highly cited papers and h-index
- iv. Core Channels of Communication and distribution of publications among these channels
- v. Geographical distribution of publications and collaborations

4. METHODOLOGY

The study of the Publications and citations of the information downloaded from the Scopus online database, it was observed that there are certain duplicate names in the list. After dropping duplicate name the list counts 291 publications during 1972-2016, which are considered for study purpose using limiting search techniques. The study identifies year, domain-wise productivity and Collaborations, collaborative pattern, mentor's authorship credibility, individual collaborator dynamics, channels of communication used and distribution of publications among channels and geographical distribution of publications with collaboration. Further, the study find out prominent collaborators, the most productive period, top ranking journals, publication density and concentration.

5. DATA ANALYSIS & DISCUSSION

The contribution of 291 publications during 1972-2016 by the mentor were analyzed year, and domain-wise, author-wise authorships credits, mentor's authorship credibility, channels of communication used, Citations, countries of productivity and subject terms used in the titles.

5.1 Year-wise Distribution of Publications

Table 1 describes year-wise contribution of 291 publications by the mentor from 1972-March 2016. He has published maximum 20 publications in the year 2009. In his 45 years of research career 1972 is the only year when he made contribution with single publication.

Table 1 Year-wise Distribution of Publications

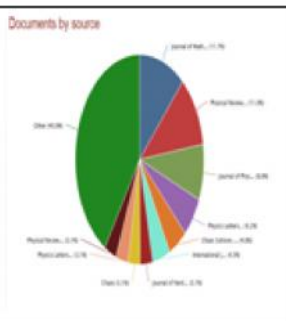
Year	Publications	Year	Publications
2016	2	1993	7
2015	14	1992	8
2014	12	1991	3
2013	10	1990	7
2012	9	1989	3
2011	8	1988	3
2010	12	1987	3
2009	20	1986	7
2008	7	1985	5
2007	10	1984	3
2006	9	1983	5
2005	15	1982	5
2004	5	1981	6
2003	4	1980	6
2002	2	1979	6
2001	8	1978	4
2000	3	1977	2
1999	6	1976	1
1998	6	1975	5
1997	16	1974	1
1996	5	1973	3
1995	5	1972	1
1994	9		

5.2 Document-wise Distribution of Publications

The table 2 depicts the top 7 document wise distribution of articles published in the sources during 1972 to 2016 by Professor M. Lakshmanan from Bharathidasan University. The productivity of scientists spreads over variety of publication media, such that journal articles; Erratum, letter; editorial materials; Notes, Reviews and so on.

Table 2 Document-wise Distribution of Publications

Document Type	Publications
Article	258
Erratum	8
Letter	8
Review	7
Conference Paper	5
Note	4
Editorial	1



It is clear from bellow table analysis that the share of journal articles is the most prominent bibliographic form of publication and it occupies 258 of total publications and followed by other sources of information.

5.3 Highly Cited Papers from Professor M. Lakshmanan

Table 3 list papers which were cited more than 80 times during 1977-2016. Data presented in snap shot and 10 papers received more than 100 citations as these have a bigger citation. Totally 5414 citations received out of 292 papers and h-index is 72. 259 paper received the citation range from 1- 100 and only 23 papers does not have citation.

5.4 Source-wise Distribution of Publications

The table 4 depicts the source wise distribution of publications, published in the journal during 1972 to 2016 by Professor M. Lakshmanan. Journal of Mathematical Physics is top ranked with 34 publications, followed by Physical Review E Statistical Nonlinear and Soft Matter Physics with 32 publications, while Journal of Physics A Mathematical and General third with 25 publications and followed by other Journal titles. SJR, SNIP, IF and IPP are the indicators for measuring the journals.

5.5 Collaborative Author-wise Distribution of Publications

It provides the detail of 121 collaborative authorships out of total 291 Publications. Among these 291 Publications, 49 publications are with V. K. Chandrasekar, 40 Publications are with M. Senthilvelan and followed by other scientists from all over the world.

5.6 Institution and Country-wise Collaboration of Professor M. Lakshmanan

Professor M. Lakshmanan has been one of the most versatile research workers in the field of Nonlinear Dynamics today at the international level (15 countries) and has contributed to the field extensively. Particularly very few people have contributed to both the fields of Solitons and Chaos, which are major constituents of Nonlinear Dynamics, on equal footing as Prof. Lakshmanan has done. His many faceted research works have enriched the subject considerably and contributed to the advancement of the general theory of solitons, integrable systems, magnetic and optical solitons,

classical chaos including bifurcations, controlling, synchronization and secure communications as well as quantum chaos and spatiotemporal patterns. Further, Dr. Lakshmanan has single handedly built an active research group of international standard in Nonlinear Dynamics and established a Centre for Nonlinear Dynamics at Bharathidasan University, Tiruchirapalli, India. However, there are hardly any sources through which other outputs of these collaborations with 70 Institutions and it could be easily documented and studied.

5.7 Subject-wise Distribution of Publications

The table 7 depicts the top 14 subject-wise distribution of articles published in different sources during 1972 to 2016. Physics and Astronomysubject istop rankedwith 236 publications, followed by Mathematics subjects with 170 publications, while Engineering subject ranked third with 21 publications and followed by remaining subjects.

Table 3 Highly Cited Papers from Professor M. Lakshmanan

☐	1 Continuum spin system as an exactly solvable dynamical system	Lakshmanan, M.	1977 Physics Letters A	237
	View at Publisher			
☐	2 Inelastic collision and switching of coupled bright solitons in optical fibers	Radhakrishnan, R., Lakshmanan, M., Hietarinta, J.	1997 Physical Review E - Statistical Physics, Plasmas, Fluids, and Related Interdisciplinary Topics	166
☐	3 Singularity analysis and localized coherent structures in (2+1)-dimensional generalized Korteweg-de Vries equations	Radha, R., Lakshmanan, M.	1994 Journal of Mathematical Physics	150
☐	4 Exact soliton solutions, shape changing collisions, and partially coherent solitons in coupled nonlinear Schrödinger equations	Kanna, T., Lakshmanan, M.	2001 Physical Review Letters	144
	View at Publisher			
☐	5 Bright and dark soliton solutions to coupled nonlinear Schrodinger equations	Radhakrishnan, R., Lakshmanan, M.	1995 Journal of Physics A: Mathematical and General	129
	View at Publisher			
☐	6 Transmission of signals by synchronization in a chaotic Van der Pol-Duffing oscillator	Murali, K., Lakshmanan, M.	1993 Physical Review E	121
☐	7 On the dynamics of a continuum spin system	Lakshmanan, M., Ruijgrok, Th.W., Thompson, C.J.	1976 Physica A: Statistical Mechanics and its Applications	118
	View at Publisher			
☐	8 Hyperchaos in a modified canonical Chua's circuit	Thamilmaran, K., Lakshmanan, M., Venkatesan, A.	2004 International Journal of Bifurcation and Chaos in Applied Sciences and Engineering	117
	View at Publisher			
☐	9 Secure communication using a compound signal from generalized synchronizable chaotic systems	Murali, K., Lakshmanan, M.	1998 Physics Letters, Section A: General, Atomic and Solid State Physics	116
☐	10 Dromion like structures in the (2+1)-dimensional breaking soliton equation	Radha, R., Lakshmanan, M.	1995 Physics Letters A	104
	View at Publisher			
☐	11 Painlevé analysis and integrability of coupled non-linear Schrödinger equations	Sahadevan, R., Tamizhmani, K.M., Lakshmanan, M.	1986 Journal of Physics A: Mathematical and General	92
	View at Publisher			
☐	12 Exact soliton solutions of coupled nonlinear Schrödinger equations: Shape-changing collisions, logic gates, and partially coherent solitons	Kanna, T., Lakshmanan, M.	2003 Physical Review E - Statistical, Nonlinear, and Soft Matter Physics	84

Table 4 Source-wise Distribution of Publications, SJR, IPP, SNIP and IF

Source Title	Publications	SJR	IPP	SNIP	IF
Journal of Mathematical Physics	34	0.722	1.032	0.905	1.243
Physical Review E Statistical Nonlinear and Soft Matter Physics	32	1.034	1.922	1.004	2.238
Journal of Physics A Mathematical and General	25	0.785	1.256	0.767	1.583
Physics Letters A	18	0.662	1.619	0.978	1.626
Chaos Solitons and Fractals	14	0.697	1.428	1.030	1.503
International Journal of Bifurcation and Chaos in Applied Sciences and Engineering	13	0.540	0.998	0.754	1.078
Journal of Nonlinear Mathematical Physics	9	0.596	0.688	0.627	0.760
Chaos	9	0.775	1.475	0.823	1.954
Physics Letters Section A General Atomic and Solid State Physics	9	0.662	1.619	0.978	-
Physical Review Letters	9	4.402	6.471	2.464	7.512

Table 5 Collaborative Author-wise Distribution of Publications

Author	Publications	Author	Publications
Chandrasekar, V.K.	49	SenthilVelan, M.	6
Senthilvelan, M.	40	Palaniyandi, P.	6
Senthilkumar, D.V.	27	Subash, B.	5
Murali, K.	21	Vijayalakshmi, S.	5
Kurths, J.	17	Ganesan, K.	5
Radha, R.	16	Rajendran, S.	5
Kanna, T.	15	Myrzakulov, R.	5
Daniel, M.	13	Nakamura, K.	5
Venkatesan, A.	13	Sakkaravarthi, K.	4
Muruganandam, P.	13	Gopal, R.	4
Sheeba, J.H.	11	Muruges, S.	4
Kaliappan, P.	10	Froman, P.O.	4
Tamizhmani, K.M.	10	Kumar, C.S.	4
Sahadevan, R.	9	Froman, N.	3
Srinivasan, K.	9	Tiwari, A.K.	3
Suresh, R.	9	Ganesan, S.	3
Porsezian, K.	8	Mohanasubha, R.	3
Vijayajayanthi, M.	8	Mathews, P.M.	3
Pandey, S.N.	8	Raja Mohamed, I.	3
Rajasekar, S.	8	Karlsson, F.	3
Radhakrishnan, R.	8	Bindu, P.S.	3
Pradeep, R.G.	7	Athavan, N.	3
Thamilmaran, K.	7	Kundu, A.	3
Parthasarathy, S.	6	Ponnuswamy, P.K.	3

Table 6 Country and Institution-wise Distribution of Publications

Country (15)	Publications	Institution (70)	Publications
Germany	21	University of Madras	32
United Kingdom	11	Potsdam Institut für Klimafolgenforschung	15
Japan	9	Humboldt-Universität zu Berlin	14
Sweden	6	Anna University	14
United States	6	SASTRA University	11
Australia	5	Bishop Heber College India	9
Kazakhstan	5	Universität Potsdam	9
Netherlands	3	Nehru Memorial College	7
France	2	Motilal Nehru National Institute of Technology	6
Belgium	1	Uppsala Universitet	6
China	1	University of Aberdeen	6
Finland	1	Government College for Women	4
Greece	1	University of Manchester	4
Italy	1	Fukuoka Institute of Technology	4
Poland	1	Kyoto University	4

Table 7 Subject-wise Distribution of Publications

Subjects	Publications
Agricultural and Biological Sciences	3
Biochemistry, Genetics and Molecular Biology	1
Chemistry	21
Computer Science	2
Decision Sciences	1
Earth and Planetary Sciences	1
Engineering	22
Environmental Science	1
Immunology and Microbiology	1
Materials Science	6
Mathematics	170
Medicine	5
Multidisciplinary	21
Physics and Astronomy	236

6. CONCLUSION

Professor M. Lakshmanan has been one of the most versatile research workers in the field of Nonlinear Dynamics today at the international level and has contributed to the field extensively. Particularly very few people have contributed to both the fields of Solitons and Chaos, which are major constituents of Nonlinear

Dynamics, on equal footing as Prof. Lakshmanan has done. His many faceted research works have enriched the subject considerably and contributed to the advancement of the general theory of solitons, integrable systems, magnetic and optical solitons, classical chaos including bifurcations, controlling, synchronization and secure communications as well as quantum chaos and spatiotemporal patterns. Further, Dr. Lakshmanan has single handedly built an active research group of international standard in Nonlinear Dynamics and established a Centre for Nonlinear Dynamics at Bharathidasan University, Tiruchirapalli, India.

In 1977, Professor Lakshmanan had made one of his outstanding contributions to Nonlinear Dynamics by proving that the continuum Heisenberg ferromagnetic spin system (this paper about has more than 300 citations (In Scopus 237 citations)) is a completely integrable soliton system, thereby leading to the notion of magnetic solitons. Finally, one must also note that Professor Lakshmanan had done yeoman service to the cause of theoretical physics and in particular Nonlinear Dynamics in India and elsewhere by developing the Centre for Nonlinear Dynamics to international level from scratch at a remote place Tiruchirapalli in southern India. The facilities at the Centre have been availed by a large number of scientists all over the country and abroad. Professor Lakshmanan is revered as a father figure in Nonlinear Dynamics by fellow scientists in India. Top 10 paper received more than 100 citations out 292 papers

and its well contribution to the Bharathidasan University. More over this study will continue with other databases like Web of Science and Indian Citation Index and so on.

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