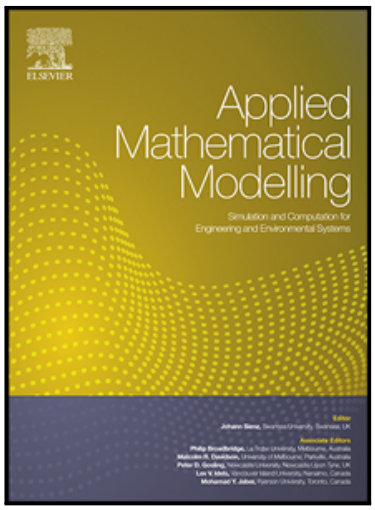

Forty years of Applied Mathematical Modelling: A bibliometric study

Rajkumar Verma , Valeria Lobos , José M. Merigó ,
Christian Cancino , Johann Sienz

PII: S0307-904X(20)30361-9
DOI: https://doi.org/10.1016/j.apm.2020.07.004
Reference: APM 13501

To appear in: *Applied Mathematical Modelling*

Received date: 11 June 2020
Revised date: 2 July 2020
Accepted date: 29 July 2020

Please cite this article as: Rajkumar Verma , Valeria Lobos , José M. Merigó , Christian Cancino , Johann Sienz , Forty years of Applied Mathematical Modelling: A bibliometric study, *Applied Mathematical Modelling* (2020), doi: https://doi.org/10.1016/j.apm.2020.07.004

Forty years of Applied Mathematical Modelling: A bibliometric study

Rajkumar Verma[1,2], Valeria Lobos[1], José M. Merigó[1,3*], Christian Cancino[1], Johann Sienz[4]

[1]Department of Management Control and Information Systems, School of Economics and Business, University of Chile, Av. Diagonal Paraguay 257, 8330015 Santiago, Chile

[2]Department of Applied Sciences, Delhi Technical Campus, (Affiliated to Guru Govind Singh Indraprastha University, Delhi) 28/1, Knowledge Park-III, Greater Noida – 201306, Uttar Pradesh, India

[3]School of Information, Systems & Modelling, Faculty of Engineering and Information Technology, University of Technology Sydney, 81 Broadway, 2007 Ultimo, NSW, Australia

[4]School of Engineering, Swansea University, Singleton Park, Swansea, SA2 8BJ, Wales, UK

Emails: rkver@gmail.com; vlobos@fen.uchile.cl; jmerigo@fen.uchile.cl; cancino@fen.uchile.cl; j.sienz@swansea.ac.uk

Corresponding author: Email: jmerigo@fen.uchile.cl

Research highlights

- A bibliometric overview of the journal between 1976 and 2016.
- Publication and citation structure of Applied Mathematical Modelling.
- Identification of the leading topics, authors, universities and countries.
- A graphical visualization by using VOS viewer software.

Abstract

The Journal of Applied Mathematical Modelling (AMM) is a leading international journal in the field of mathematics and engineering focused on research related to mathematical modelling of engineering and environmental processes, manufacturing, and industrial systems, whose first issue was published in 1976. Motivated by the 40th anniversary in 2016, this study aims to develop a bibliometric overview of the publications published in the journal from 1976 to 2016. The objective of this work is to identify the leading variables and trends which have influenced the journal most during these years. In doing so, the study uses the Web of Science Core Collection database to analyze the data. This work also develops a graphical mapping of the bibliometric material by using the visualization of

similarities (VOS) viewer software. These graphs represent bibliographic coupling, citation and co-citation analysis, co-authorship and co-occurrence of keywords. The results show the diversity of the published documents and significant growth of the journal through time.

Keywords

Bibliometrics; journal; Web of Science; VOS viewer.

1. Introduction

The Journal of Applied Mathematical Modelling (AMM) is a leading international journal in the field of mathematics and engineering focused on research related to mathematical modelling of engineering and environmental processes, manufacturing, and industrial systems. The Journal also publishes significant contributions on emerging areas involving multiphysics processes. Primarily, Applied Mathematical Modelling considers research papers on developing increased insights into real-world problems through novel mathematical modelling, novel applications or a combination of these. Papers on fuzzy logic in decision-making or purely financial mathematics are normally not published by the journal. In general, submissions without real-world application are not considered for publication in AMM.

Professor C.A. Brebbia, Southampton University, UK, was the first Editor in Chief and Founder of Applied Mathematical Modelling. The first volume of AMM was published in 1976-77 which included seven issues and totaling 304 pages. The publisher of the journal was IPC Science and Technology Press, England, which was later acquired by Elsevier. In 1978, the journal started publishing 6 issues per year and in 1988, it increased to twelve issues. In 2013, it grew again publishing twenty-four issues per year and since 2012, the journal is publishing one volume per month of around 780 pages. Today, AMM is widely recognized by the scientific community as a highly reputable journal in the field of applied mathematics, modelling and simulation. Presently, Professor Johann Sienz, Swansea University, Swansea, Wales, UK, is the Editor in Chief of AMM. AMM is indexed in all the major databases including Scopus, Science Citation Index Expanded, Web of Science, Computer & Control Abstracts, SCISEARCH, Electronics and Communications Abstracts, CAD/CAM Abstracts, COMPENDEX, EMBASE, Current Contents/Engineering, Computing & Technology, Mathematical Reviews and Zentralblatt Math. In the 2016 Journal Citation Report of the Web of Science, the journal has an impact factor of 2.350

and source normalized impact factor per paper of 1.748. For current journal metrics, please visit the journal details at: https://journalinsights.elsevier.com/journals/0307-904X, for instance, the current impact factor is given here: https://journalinsights.elsevier.com/journals/0307-904X/impact_factor.".

Bibliometrics is an important tool for assessing and analyzing the published scientific literature from a quantitative perspective. In recent years, a wide range of bibliometric studies have been developed covering journals, topics, countries, and institutions. The studies focused on journals include Strategic Management Journal [1], Knowledge-Based Systems [2], Computers and Industrial Engineering [3], European Journal of Operational Research [4] and Information Sciences [5]. Regarding topics, it is worth mentioning some key areas, including computational intelligence [6], fuzzy research [7-8], data mining [9] and operations research and management science [10]. Additionally, note that there are also a number of studies that have focused on countries [11-12] and institutions [13].

In 2016, AMM celebrated its 40th anniversary. Motivated by this milestone, the aim of this paper is to develop a general bibliometric analysis of the leading trends occurring therein. We identify and visualize the most significant aspects of the journal in terms of most cited papers, authors, institutions, and countries. In order to do so, this study analyzes all the documents published in the journal between 1976 and 2016 using Web of Science Core Collection. Moreover, the paper also applies the Visualization of Similarities (VOS) viewer software [14] to map graphically the bibliometric data by employing a wide range of bibliometric methods including bibliometric coupling [15], co-citation [16], citation, co-authorship, and co-occurrence of keywords.

The paper is organized as follows. Section 2 describes the bibliometric methods used in this paper. Section 3 presents the results including the publication and citation structure, the leading authors, influential papers in the AMM, institutions, countries publishing in the journal, and the most-cited papers. Section 4 develops a graphical analysis of the bibliographic data of AMM with VOS viewer software. Section 5 gives a short description of the main findings and conclusions of the paper.

2. Methods

Bibliometrics is the research area of library and information sciences that studies bibliographic material such as research publications, authors, countries contributions, among others, by using a quantitative approach [17-18]. In the past few years, the development of bibliographic studies has increased exponentially due to the availability of computers and fast internet. This type of study is very useful in order to classify and provide a general overview of a set of bibliometric documents. In this work, we are making a bibliometric analysis of a specific journal, namely, Applied Mathematical Modelling. Single journal studies are important because they reveal significant journal features, such as the themes published, geographical distribution and citation patterns, to future journal authors. In the literature, many articles have been published focusing on the bibliometric analysis of specific journals [19-21].

There is a wide range of bibliometric indicators that can be implemented for developing a bibliometric review. The aim of the indicator is to provide a representative and informative perspective of the available data. Among others, this work uses the total number of publications, and citations, citation per years, citing articles, *h*-index and citation threshold. Note that rankings may be different depending on the specific bibliometric indicator considered. In general, productivity and influence are two major characteristics to evaluate research data [22]. Productivity is measured by the number of publications and influence with number of citations. The *h*-index is a numerical indicator to measure the productivity and influence of a researcher simultaneously. It was invented by Jorge Hirsch [23] in 2005, a physicist at the University of California. He explains it as "*A scientist has index h if h of his/her X papers have at least h citations each, and the other (X−h) papers have no more than h citations each."* The overall aim of this study is to explore the bibliometric characteristics of AMM over the past 40 years in honour of the 40th anniversary of the journal so each reader can understand the data according to their particular interest and at the same time identify strengths and opportunities for the journal as a whole.

The bibliometric data for the study come from the WoS core collection database. The search process uses the keyword 'Applied Mathematical Modelling' and was carried out in October 2017. This study considers all the documents published in the journal up to 31 December 2016. The search found 6643 documents published in the journal during this period. Up to December 2016, the journal had 66388 citations coming from the other

sources available in WoS core collection database which gives a cites per paper ratio of 9.99. The h-index is 80.

Further, to obtain a more general view of the results, the study also develops a graphical analysis of the bibliographic material by using the VoS viewer software [14]. For doing so, this involves generating different maps in terms of citation, co-citation, bibliographic coupling, co-authorship, and co-occurrence of author keyword [24]. Recall that bibliographic coupling occurs when two documents cite the same third document [25]. Co-citation appears when two documents receive a citation from the same third document [26]. Citation analysis gives a measure of the relative importance or impact of an author, an article or a publication by counting the number of times that author, article, or publication has been cited by others. Co-authorship measures the degree of co-authors between the most productive sources. Co-occurrence of author keywords identifies pairs of keywords that appear more frequently in the same document [4-5]. Finally, note that in the literature a wide range of software is available for mapping of bibliometric data [27].

3. Results

This section presents the results of the paper. The work analyzes the publication and citation structure of AMM and the most productive and influential authors, institutions and countries of the journal.

3.1. Publication and citation structure of AMM

The first volume of Applied Mathematical Modelling was published in 1976-77. It contained in total 7 issues and 87 research articles. Due to the widespread use of mathematical modelling in different problems, the journal has grown significantly through time. Figure 1 presents the annual number of documents published in the journal. Note that the figure only considers articles, reviews, letters, and notes.

During the first twenty years, the number of publications in AMM increased slowly and reached ninety-four in 1996. From 1997 to 2005, this number decreased and the journal published around 70 articles per year. Since 2006, the number of publications in AMM is growing more significantly and a record of 773 in 2013. The number of published documents was 708 in 2016.

Next, let us look into the annual citations structure of AMM. Table 1 presents the number of documents published in the journal annually and a total number of citations achieved by the journal per year up to December 2016. It appears from Table 1 that the number of citations is growing through time especially thanks to the significant growth of research worldwide and the Web of Science database. According to the Journal Citation Report of 2016, Applied Mathematical Modelling publishes 7.7% of all papers published in 2016 in journals indexed in the Web of Science category of "Mathematics, Interdisciplinary Applications" and receives about 4.45% of all citations. 0.05% of the papers attracted greater than or equal to 200 citations and 0.53% attracted more than or equal to 100 citations. Note that approximately 52% documents have received at least five citations and 88% of the papers at least have one citation. In total, the journal has received approximately sixty-six thousand citations since its creation, considering documents indexed in the WoS.

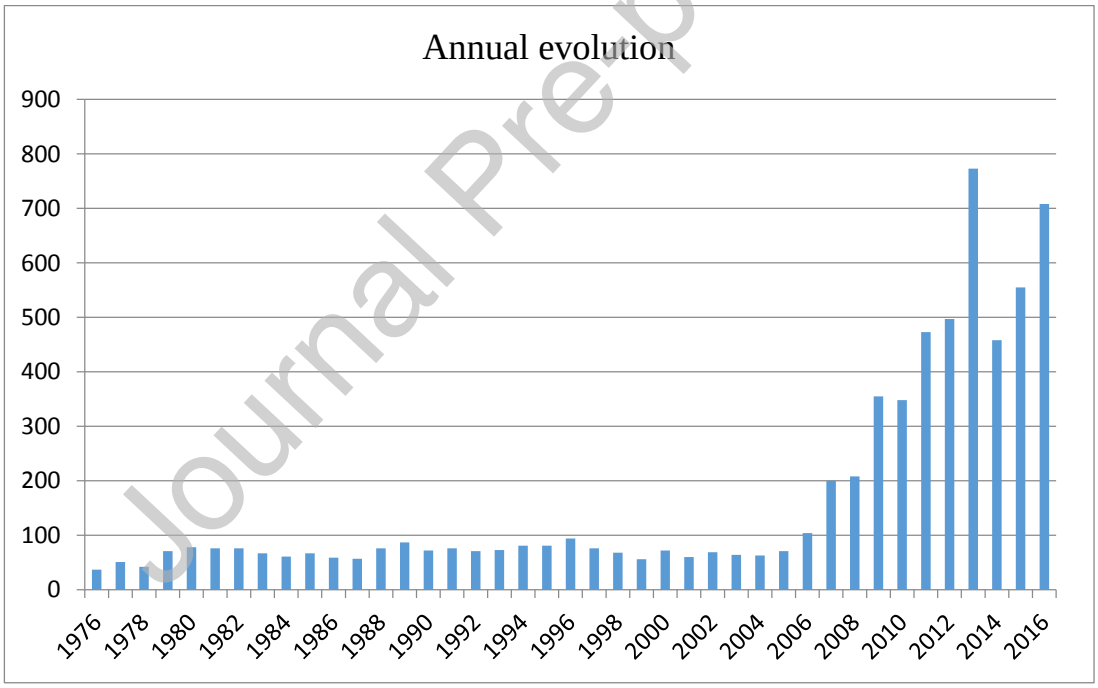

Figure 1: Annual number of papers published in AMM

Table 1: Annual citation structure of AMM

Year	TP	TC	≥200	≥100	≥50	≥20	≥10	≥5	≥1
1976	37	231	0	0	0	3	8	13	37

1977	51	272	0	0	0	4	7	14	51
1978	42	340	0	1	2	3	5	12	34
1979	71	521	0	0	5	5	9	20	48
1980	78	335	0	0	0	5	9	19	54
1981	76	588	0	1	2	6	12	23	59
1982	76	557	0	0	2	8	14	22	60
1983	67	685	0	1	4	8	15	25	54
1984	61	634	0	1	4	6	11	23	53
1985	67	474	0	0	1	5	18	26	58
1986	59	552	0	1	2	9	11	18	44
1987	57	378	0	0	0	7	11	23	42
1988	76	569	0	0	1	6	18	37	65
1989	87	464	0	0	1	3	14	26	63
1990	72	416	0	0	0	6	15	24	53
1991	76	504	0	0	1	6	14	28	58
1992	71	551	0	1	1	5	16	29	55
1993	73	483	0	0	0	6	20	33	61
1994	81	651	0	0	1	9	25	39	71
1995	81	738	0	0	2	11	23	44	68
1996	94	856	0	0	2	12	27	49	88
1997	76	713	0	0	2	9	26	41	68
1998	68	1069	0	1	3	15	35	49	65
1999	56	831	0	0	3	16	27	40	55
2000	72	1274	0	1	6	18	36	54	70
2001	60	877	0	0	1	17	27	38	55
2002	69	1472	1	1	6	22	36	51	67
2003	64	1139	0	2	2	20	33	48	61
2004	63	935	0	0	1	19	35	48	60
2005	71	1037	0	0	2	15	42	53	66
2006	104	1641	1	1	4	25	51	76	102
2007	200	3130	0	2	11	49	98	153	188
2008	208	2951	0	2	7	48	93	143	198
2009	355	5436	0	2	16	93	193	256	334
2010	348	5901	0	6	22	94	194	262	333
2011	473	6509	0	5	19	85	204	319	448
2012	497	5819	0	1	14	74	202	330	464
2013	773	8727	1	4	21	116	285	491	720
2014	458	3100	0	0	4	26	96	227	413
2015	555	2265	0	1	2	10	56	156	439
2016	708	1266	0	0	0	3	18	70	447
Total	6643	66388	3	35	177	907	2089	3452	5829
%	100%		0,05%	0,53%	2,66%	13,65%	31,45%	51,96%	87,75%

Abbreviations: TP and TC = Total papers and citations; ≥200, ≥100, ≥50, ≥20, ≥10, ≥5, ≥1 = Number of papers with equal or more than 200, 100, 50, 20, 10, 5 and 1 citations.

3.2.**Influential papers in AMM**

Applied Mathematical Modelling has published many significant contributions in the field of mathematical modeling and their applications. Table 2 presents a list of 50 most

influential papers of all time appearing in AMM. Observe that in the case of a tie in the number of citations, the youngest paper appears first in the list.

The most cited paper is from 2002 by Paul W Cleary & Mark L Sawley and has 257 citations. In this paper, the authors discussed the DEM modelling of industrial granular flows with three dimensional (3D) case studies. The second most cited paper was written by Ashraf M. Zenkour in 2006 on the topic generalized shear deformation theory. It has 231 citations. The third and fourth most cited papers were published in 2013 and 2000 respectively. Note that the paper appeared in the list at the 13th position has the highest number of cites per year.

Table 2: The 50 most cited documents in AMM

R	Title	Author/s	TC	Year	Citations per year
1	Dem modelling of industrial granular flows: 3d case studies and the effect of particle shape on hopper discharge	Cleary, PW; Sawley, ML	257	2002	18,36
2	Generalized shear deformation theory for bending analysis of functionally graded plates	Zenkour, AM	231	2006	23,10
3	The effects of MHD and temperature dependent viscosity on the flow of non-Newtonian nanofluid in a pipe: analytical solutions	Ellahi, R	228	2013	76,00
4	Smooth and non-smooth traveling waves in a nonlinearly dispersive equation	Li, JB; Liu, ZR	190	2000	11,88
5	2-point estimates in probabilities	Rosenblueth, E	184	1981	5,26
6	Analytic network process in supplier selection: a case study in an electronic firm	Gencer, Cevriye; Guerpinar, Didem	180	2007	20,00
7	Numerical methods for fractional partial differential equations with Riesz space fractional derivatives	Yang, Q.; Liu, F.; Turner, I.	169	2010	28,17
8	Free vibration characteristics of a functionally graded beam by finite element method	Alshorbagy, Amal E.; Eltaher, MA; Mahmoud, FF	167	2011	33,40
9	Modelling confined multi-material heat and mass flows using SPH	Cleary, PW	161	1998	8,94
10	A robust optimization approach to closed-loop supply chain network design under uncertainty	Pishvaee, Mir Saman; Rabbani, Masoud; Torabi, Seyed Ali	152	2011	30,40
11	Eulerian and Lagrangian predictions of particulate 2-phase flows - a numerical study	Durst, F; Milojevic, D; Schonung, B	149	1984	4,66
12	The discrete element method for the simulation of ball mills	Mishra, BK; Rajamani, RK	146	1992	6,08
13	A new hyperbolic shear deformation theory for bending and free vibration analysis of isotropic, functionally graded, sandwich and laminated composite plates	Mahi, Amale; Bedia, El Abbas Adda; Tounsi, Abdelouahed	143	2015	143,00
14	A new approach to free-vibration analysis using boundary elements	Nardini, D; Brebbia, CA	143	1983	4,33
15	Correlation coefficients of hesitant fuzzy sets and their applications to clustering analysis	Chen, Na; Xu, Zeshui; Xia, Meimei	135	2013	45,00
16	Bending analysis of microtubules using nonlocal Euler-Bernoulli beam theory	Civalek, Omer; Demir, Cigdem	135	2011	27,00
17	Multiple criteria facility location problems: a survey	Farahani, Reza Zanjirani; Steadieseifi, Maryam; Asgari, Nasrin	133	2010	22,17
18	Finite-time synchronization of two different chaotic systems with unknown parameters via sliding mode technique	Aghababa, Mohammad Pourmahmood; Khanmohammadi, Sohrab; Alizadeh, Ghassem	131	2011	26,20
19	An EOQ model for deteriorating items under supplier credits linked to ordering quantity	Chang, CT; Ouyang, LY; Teng, JT	125	2003	9,62
20	Finite-time stochastic synchronization of complex networks	Yang, Xinsong; Cao, Jinde	120	2010	20,00
21	Static response and free vibration analysis of FGM plates using higher order shear deformation theory	Talha, Mohammad; Singh, B. N.	119	2010	19,83
22	Extension of the TOPSIS method for decision making problems under interval-valued intuitionistic fuzzy environment	Park, Jin Han; Park, Il Young; Kwun, Young Chel; et al.	115	2011	23,00
23	Ranking fuzzy numbers by distance minimization	Asady, B.; Zendehnam, A.	115	2007	12,78
24	Approximation of function and its derivatives using radial basis function networks	Mai-Duy, N; Tran-Cong, T	114	2003	8,77
25	A new Jacobi operational matrix: an application for solving fractional differential equations	Doha, EH; Bhrawy, AH; Ezz-Eldien, SS	113	2012	28,25
26	Static analysis of functionally graded beams using higher order shear deformation theory	Kadoli, Ravikiran; Akhtar,	113	2008	14,13

27	Multicriteria fuzzy decision-making method using entropy weights-based correlation coefficients of interval-valued intuitionistic fuzzy sets	Kashif; Ganesan, N. Ye, Jun	111	2010	18,50
28	A genetic algorithm approach for solving a closed loop supply chain model: a case of battery recycling	Kannan, G.; Sasikumar, P.; Devika, K.	111	2010	18,50
29	2-dimensional bie fracture mechanics analysis	Cruse, TA	110	1978	2,89
30	A model of oxidation in pyritic mine wastes 1. Equations and approximate solution	Davis, GB; Ritchie, AIM	109	1986	3,63
31	Numerical methods for nonlinear partial differential equations of fractional order	Odibat, Zaid; Momani, Shaher	105	2008	13,13
32	Discrete grey forecasting model and its optimization	Xie, Nai-Ming; Liu, Si-Feng	104	2009	14,86
33	Finite difference approximations for the fractional Fokker-Planck equation	Chen, S.; Liu, F.; Zhuang, P.; et al.	103	2009	14,71
34	Extension of VIKOR method for decision making problem based on hesitant fuzzy set	Zhang, Nian; Wei, Guiwu	102	2013	34,00
35	The mathematical-modeling of turbulent flows	Markatos, NC	99	1986	3,30
36	MHD flow and radiation heat transfer of nanofluids in porous media with variable surface heat flux and chemical reaction	Zhang, Chaoli; Zheng, Liancun; Zhang, Xinxin; et al.	98	2015	98,00
37	A method for group decision-making based on determining weights of decision makers using TOPSIS	Yue, Zhongliang	97	2011	19,40
38	Nicholson's blowflies differential equations revisited: main results and open problems	Berezansky, L.; Braverman, E.; Idels, L.	96	2010	16,00
39	Extension of VIKOR method for decision making problem with interval numbers	Sayadi, Mohammad Kazem; Heydari, Majeed; Shahanaghi, Kamran	96	2009	13,71
40	Numerical study of gas-solid flow in a cyclone separator	Wang, B.; Xu, DL; Chu, KW; et al.	96	2006	9,60
41	Multi-objective optimization of heat exchangers using a modified teaching-learning-based optimization algorithm	Rao, R. Venkata; Patel, Vivek	94	2013	31,33
42	Efficient Chebyshev spectral methods for solving multi-term fractional orders differential equations	Doha, EH; Bhrawy, AH; Ezz-Eldien, SS	94	2011	18,80
43	Heat transfer in MHD viscoelastic fluid flow over a stretching sheet with variable thermal conductivity, non-uniform heat source and radiation	Abel, M. Subhas; Mahesha, N.	94	2008	11,75
44	Probabilistic estimates for multivariate analyses	Harr, ME	93	1989	3,44
45	Finite element analysis and modelling of structure with bolted joints	Kim, Jeong; Yoon, Joo-Cheol; Kang, Beom-Soo	92	2007	10,22
46	A new and dynamic method for unconstrained minimization	Snyman, JA	92	1982	2,71
47	Bias compensation methods for stochastic systems with coloured noise	Zhang, Yong; Cui, Guimei	91	2011	18,20
48	Yard crane scheduling in port container terminals	Ng, WC; Mak, KL	91	2005	8,27
49	Electric load forecasting by support vector model	Hong, Wei-Chiang	90	2009	12,86
50	Size dependent buckling analysis of functionally graded micro beams based on modified couple stress theory	Nateghi, A.; Salamat-Talab, M.; Rezapour, J.; et al.	89	2012	22,25

Another interesting issue is to consider those documents that receive most citations from papers published in AMM. To assess this issue, our study uses the VoS viewer software and generates the co-citations of documents to identify those documents that are cited most by articles in the journal. Table 3 presents the 40 most cited documents.

In the list, the first position goes to a book written by Suhas Patankar entitled "*Numerical Heat Transfer and Fluid Flow*". The second most cited document in the journal is the seminal paper of Lofti A. Zadeh about fuzzy sets which appeared in Information and Control in 1965. Note that this paper is the most cited paper of all time in computer science and among the fifty most cited of all-time in all sciences [7]. C.A. Brebbia and D. Biskuphas have three and two documents respectively in the top 40. Six research papers are among the ten most cited documents in the journal and twenty are in the top 40.

Table 3: Top 40 most cited documents in AMM publications

Rank	Year	Reference	Type	TC	Co-citations

1	1980	Patankar S, Numerical Heat Trans	B	131	57
2	1965	Zadeh LA, Inform Control, V8, P338	A	90	58
3	1999	Podlubny I, Fractional Different	B	89	63
4	1974	Launder BE, Computer Methods in Applied Mechanics and Engineering, V3, P269	A	74	42
5	1979	Graham RL, Discrete Optimisation, P287	A	55	47
6	1984	Brebbia CA, Boundary Element Tec	B	54	19
7	1981	Hirt CW, J Comput Phys, V39, P201	A	50	30
8	1978	Charnes A, Eur J Oper Res, V2, P429	A	49	31
9	1978	Brebbia CA, Boundary Element Met	B	48	27
10	1972	Patankar SV, Int J Heat Mass Tran, V15, P1787	A	46	35
11	1980	Brebbia CA, Boundary Element Tec	B	45	27
12	1986	Doshi BT, Queueing Systems Theory And Applications, V1, P29	A	45	25
13	1995	Kennedy J, Ieee Int Conf Neural Networks Proc, Vols 1-6, P1942	C	42	17
14	1993	Kuang Y, Delay Differential E	B	41	11
15	1981	Neuts MF, Matrix Geometric Sol	B	38	12
16	2004	Cheng TCE, Eur J Oper Res, V152, P1	A	37	37
17	1983	Eringen AC, J Appl Phys, V54, P4703	A	37	22
18	1999	Alidaee B, J Oper Res Soc, V50, P711	A	36	36
19	1999	Biskup D, Eur J Oper Res, V115, P173	A	36	36
20	2008	Biskup D, Eur J Oper Res, V188, P315	A	36	36
21	1959	Carslaw HS, Conduction Heat Soli	B	36	14
22	1977	Zienkiewicz OC, Finite Element Metho	B	36	15
23	1989	Goldberg D, Genetic Algorithms S	B	35	25
24	1975	Holland JH, Adaptation Natural A	B	35	24
25	1986	Atanassov KT, Fuzzy Set Syst, V20, P87	A	33	26
26	1980	Saaty TL, Anal Hierarchy Proce	B	33	19
27	1959	Timoshenko S, Theory Plates Shells	B	33	15
28	1979	Leonard BP, Comput Method Appl M, V19, P59	A	32	22
29	1981	Hwang CL, Multiple Attribute D	B	31	25
30	1979	Nayfeh AH, Nonlinear Oscillatio	B	31	8
31	1984	Banker RD, Manage Sci, V30, P1078	A	30	28
32	1974	Oldham KB, Fractional Calculus	B	30	27
33	1988	Osher S, J Comput Phys, V79, P12	A	30	14
34	2008	Gawiejnowicz S, Monogr Theor Comput, P3	A	29	26
35	1985	Beck JV, Inverse Heat Conduct	B	28	5
36	1985	Goyal SK, J Oper Res Soc, V36, P335	A	28	21
37	1989	Lakshmikantham V, Theory Impulsive Dif	B	28	7
38	1967	Lord HW, J Mech Phys Solids, V15, P299	A	28	23
39	1970	Timoshenko SP, Theory Elasticity	B	28	13
40	1994	Belytschko T, Int J Numer Meth Eng, V37, P229	A	27	17

Another important issue is to consider which universities, countries and journals cite published articles from AMM more frequently. Table 4 presents this information.

The Islamic Azad University leads the table in terms of institutions and has more than1100 documents citing AMM. The second position goes to Indian Institute of Technology, India and third to King Abdulaziz University, Saudi Arabia. In terms of countries, China obtains the first position over the USA with more than fifteen thousand documents citing AMM journal. Additionally, Iran and India have the third and fourth position, respectively and UK, Canada, and Australia appear in top 10. As is common for most journals, the largest numbers of published articles in AMM are cited by other articles published in the same journal. Applied Mathematics and Computation, Mathematical Problems in Engineering and Engineering Analysis with Boundary Elements show a strong connection with AMM.

Table 4: Citing articles of AMM (2007-2016): Universities, countries, and journals

R	University	TP	Country	TP	Journal	TP
1	Islamic Azad U	1148	China	15114	Appl Math Model	2798
2	Indian Inst Tech	953	USA	5153	Appl Math Comput	914
3	King Abdulaziz U	708	Iran	4981	Math Prob Engin	659
4	Amirkabir U Technology	551	India	3253	Engin Anal Bound Elem	514
5	CNRS France	542	UK	2486	Int J Heat Mass Transfer	504
6	U Tehran	494	Canada	1781	Composite Structures	466
7	Chinese Acad Sci	443	Australia	1710	Computers Indust Engin	419
8	Quaid I Azam U	433	Turkey	1633	Nonlinear Dynamics	383
9	Dalian U Technology	419	France	1344	J Intel Fuzzy Syst	363
10	Harbin Inst Tech	413	Saudi Arabia	1336	Computers Math Applic	344
11	Iran U Sci Tech	405	Spain	1184	Int J Adv Manuf Tech	304
12	Huazhong U Sci Tech	367	Italy	1141	Int J Production Research	297
13	Sharif U Technology	354	Egypt	1085	Int J Numer Meth Engin	288
14	Shanghai Jiao Tong U	343	Germany	1020	Int J Numer Meth Fluids	284
15	Xi An Jiaotong U	340	South Korea	939	Appl Soft Computing	272
16	Tsinghua U	327	Pakistan	926	European J Oper Res	267
17	Nat Cheng Kung U	319	Japan	687	Com Nonlin Sci Num Sim	265
18	Central South U	313	Brazil	651	Abstract Appl Anal	259
19	Southeast U China	311	Malaysia	615	J Computational Physics	249
20	U California System	302	Poland	508	J Comput Appl Math	248
21	Tongji U	290	Netherlands	438	Expert Syst Applic	247
22	Zhejiang U	288	Greece	437	Appl Thermal Engin	239
23	Hong Kong Polytech U	277	South Africa	430	Chemical Engin Sci	237
24	Northeastern U China	267	Portugal	376	Comp Meth Appl Mech Eng	234
25	City U Hong Kong	254	Mexico	347	Powder Technology	228
26	Indian Inst Tech Kharagpur	253	Romania	337	J Applied Mathematics	225
27	CSIRO	252	Belgium	331	Int J Mechanical Sciences	222
28	Beihang U	249	Russia	325	Neurocomputing	219
29	Hunan U	244	Singapore	307	Int J Production Econ	215
30	Northwestern Polytech U	243	Algeria	300	J Sound And Vibration	207

Abbreviations available in previous tables.

3.3. **Leading authors, institutions and countries**

Many important contributions have been published in the journal by a wide range of authors, institutions, and countries. Table 5 presents a list of the 50 most productive authors in AMM. Note that some other indicators are also included for providing the detailed information about authors.

Paul W. Cleary obtains the first position with more than six hundred citations. However, in terms of productivity, Mark Cross is the most productive author followed by Xi Wang. In the list, 33 authors belong to Asia, 6 to North America, 6 to Europe and 5 to Australia. Note that other authors have also made a remarkable contribution to the journal particularly Mohamad Y Jaber, Jauchuan Ke, Ji-bo Wang and Manoranjan K. Maiti.

In order to deepen the results of Table 5, let us examine the productivity and influence of the leading authors over time. For doing so, Table 6 presents a temporal analysis of the fifty most productive authors. As can be seen in Table 6, during the first ten years, Carlos A Brebbia was the most productive as well as a most influential author in AMM. From 1987 to 1996, Mark Cross had received maximum citations and published 12 papers in the journal. In last five years, Mehdi Dehghan is the most productive and influential author in the journal.

Table 5: Top 50 leading authors in AMM

R	FULL NAME	University	Country	TC	TP	TH	TC/TP	>100	>50	>10
1	Cleary, Paul W.	CSIRO Data61, Melbourne	AUS	676	17	10	39,76	1	2	4
2	Brebbia, Carlos A.	Wessex Institute of Technology	UK	595	21	11	28,33	0	1	4
3	Dehghan, Mehdi	Amirkabir U Technology	IRA	550	19	13	28,95	0	0	3
4	Liu, Fa Wang	Queensland U Technology	AUS	519	18	10	28,83	0	2	2
5	Turner, Ian W.	Queensland U Technology	AUS	490	22	11	28,82	0	1	1
6	Cross, Mark	Swansea U	UK	477	30	13	15,90	0	0	2
7	Wang, Ji-bo	Shenyang Aerospace U	CHN	409	21	13	19,48	0	0	1
8	Tavakkoli-Moghaddam, Reza	U Tehran	IRA	405	17	11	23,82	0	0	3
9	Jaber, Mohamad Y	Ryerson U	CAN	383	24	13	15,96	0	0	1
10	Ke, Jauchuan	National Taichung U Sci Tech	TWN	381	24	13	15,88	0	0	0
11	Markatos, Nikolaos Christos	National Technical U Athens	GRE	319	16	11	19,94	0	0	1
12	Wang, Xi	Shanghai Jiaotong U	CHN	303	25	25	12,12	0	0	2
13	Chang, Ching Ter	Chang Gung U	TWN	292	10	8	29,20	0	1	2
14	Mousavi, Seyed Meysan	Shahed U	IRA	285	12	9	23,75	0	0	2
15	Fletcher, Davi F.	U Sydney	AUS	280	15	9	18,67	0	0	2
16	Maiti, Manoranjan K.	Vidyasagar U	IND	278	21	10	13,24	0	0	0
17	Sládek, Ján	Slovak Academy of Sciences	SLK	276	10	7	27,60	0	0	2
18	Sládek, Vladimír	Slovak Academy of Sciences	SLK	276	10	7	27,60	0	0	2
19	Lee, Wen Chiung	Feng Chia U	TWN	256	11	7	23,27	0	0	1
20	Zhang, Yong	Inner Mongolia U Sci & Tech	TWN	254	17	9	14,94	0	0	1
21	Wang, Kuo Hsiung	Providence U Taiwan	TWN	237	12	9	19,75	0	0	0

22	Chen, Chang Kuo	National Cheng Kung U	TWN	218	14	9	15,57	0	0	1
23	Cárdenas-Barrón, Leopoldo E	Tecnologico de Monterrey	MEX	186	11	8	16,91	0	0	0
24	Jolai, Fariborz	U Tehran	IRA	184	16	8	11,50	0	0	0
25	Lotfi, Farhad Hosseinzadeh	Islamic Azad U	IRA	181	13	8	13,92	0	0	1
26	Ray, Asok	Ray, Asok	USA	149	10	7	14,90	0	0	0
27	Malmborg, Charles J.	Rensselaer Polytechnic Institute	USA	147	17	7	8,65	0	0	1
28	Pericleous, Kyriacos	U Greenwich	UK	145	10	7	14,50	0	0	0
29	Sun, Fengrui	Naval U Engineering	CHN	141	12	7	11,75	0	0	0
30	Chen, Lin Gen	Naval U Engineering	CHN	134	10	7	13,40	0	0	0
31	Kumar, Amit	Thapar U	IND	134	11	5	12,18	0	0	1
32	Tanaka, Masataka	Shinshu U	JAP	134	13	8	10,31	0	0	0
33	Hosseini-Hashemi, Shahrokh	Iran U Science and Technology	IRA	121	10	5	12,10	0	0	0
34	Wang, Xiao-Yuan	Shenyang Inst Aeronautical Eng	CHN	116	10	7	11,60	0	0	0
35	Wang, Lin	Huazhong U Sci Tech	CHN	107	15	5	7,13	0	0	0
36	Shieh, Leang San	U Houston	USA	99	16	5	6,19	0	0	0
37	Wang, Jun	Beijing U Aeronaut & Astronaut	CHN	93	11	6	8,45	0	0	0
38	Lü, Zhen Zhou	Northwestern Polytechnical U	CHN	92	11	6	8,36	0	0	0
39	Feng, En Min	Dalian U Technology	CHN	90	17	5	5,29	0	0	0
40	Wang, Ke	Harbin Institute of Technology	CHN	90	10	6	9,00	0	0	0
41	Fu, Chu Li	Lanzhou U	CHN	89	11	6	8,09	0	0	0
42	Davey, Keith	U Manchester	UK	88	11	5	8,00	0	0	0
43	Salarieh, Hassan	Sharif U Technology	IRA	80	11	5	7,27	0	0	0
44	Ramos, Juan I.	Universidad de Malaga	SPA	77	19	6	4,05	0	0	0
45	Fung, Rong Fong	Nat Kaohsiung First U Sci Tech	TWN	73	15	6	4,87	0	0	0
46	Tsai, Jason Sheng-Hong	National Cheng Kung U	TWN	68	12	5	5,67	0	0	0
47	Feng, Xin Long	Xinjiang U	CHN	66	13	5	5,08	0	0	0
48	Liao, Chung-Min	National Taiwan U	TWN	55	10	5	5,50	0	0	0
49	Segall, Richard S.	Arkansas State U	USA	36	11	4	3,27	0	0	0
50	Greenspan, Donald	U Texas Arlington	USA	32	10	4	3,20	0	0	0

The previous table shows the most cited authors among those with at least 10 papers.

Table 6: Temporal analysis of most contributing authors

R	Author	TC	TP
	1976-1981		
1	Brebbia, CA	314	18
2	Uri, ND	5	6
3	Davis, RP	10	4
4	Telles, JCF	103	3
5	Spalding, DB	74	3
	1982-1986		
1	Brebbia, CA	297	8
2	Sladek, V	242	7
3	Sladek, J	242	7
4	Cross, M	42	5
5	Ramos, JI	11	5
	1987-1991		
1	Cross, M	96	6
2	Malmborg, CJ	43	6
3	Segall, RS	24	6
4	Ahmadi, G	33	5
5	Hearn, CJ	22	5
	1992-1996		
1	Cross, M	121	6
2	Boulos, PF	58	5
3	Uri, ND	13	5
4	Jaber, MY	137	4
5	Altman, T	54	4

R	Author	TC	TP
	2007-2011		
1	Ke, JC	214	14
2	Wang, JB	274	11
3	Maiti, M	148	11
4	Fung, RF	61	10
5	Sun, FR	112	9
6	Zhang, Y	218	8
7	Wang, X	149	8
8	Chen, LG	108	8
9	Song, XY	82	8
10	Lee, WC	234	7
11	Hayat, T	207	7
12	Lotfi, FH	143	7
13	Chen, LS	121	7
14	Huang, LH	114	7
15	Cleary, PW	90	7
	2012-2016		
1	Dehghan, M	264	15
2	Jaber, MY	151	15
3	Tavakkoli-Moghaddam, R	307	14
4	Wang, X	113	13
5	Liu, F	139	12
6	Feng, EM	53	12
7	Mousavi, SM	218	11

	1997-2001		
1	Liao, CM	35	6
2	Ramos, JI	20	5
3	Whalley, R	2	5
4	Chen, CK	123	4
5	Fletcher, DF	120	4
	2002-2006		
1	Pericleous, K	84	5
2	Attia, HA	51	5
3	Langrish, TAG	132	4
4	Fletcher, DF	132	4
5	Schwarz, MP	115	4
8	Wang, Y	20	11
9	Wang, JB	135	10
10	Jolai, F	123	10
11	Lu, ZZ	81	10
12	Ai, ZY	12	10
13	Ansari, R	133	9
14	Li, L	63	9
15	Feng, XL	37	9
16	Zhang, Y	36	9
17	Wang, L	12	9
18	Ding, F	433	8
19	Bashiri, M	153	8
20	Turner, I	99	8

Next, let us look into the leading institutions of the journal. In order to identify the most productive ones, Table 7 shows the institutions with the highest number of papers published in AMM. In the case of a tie, the ranking is made by the number of citations. Additionally, Table 7 also presents several other indicators including the h-index, the cites per paper and citation thresholds.

The Islamic Azad University is the most productive and influential institution in the journal. The second position goes to Indian Institute of Technology, India. In terms of cites per paper, Jiangnan University obtains the first position followed by Southeast University China. As we have seen, Asia leads the list with more than 70% institutions. This shows the high influence of Asian institutions in AMM. In order to analyze the results throughout time, Table 8 presents a temporal analysis of the 40 most contributing institutions.

During the first ten years of the journal, University of Southampton was the most influential institution in the journal. However, through time many other institutions have emerged as more productive and relevant. In current years, Islamic Azad University, Iran, is the leading institution in AMM followed by Indian Institute of Technology, India.

Table 7: The most productive and influential institutions in AMM

R	University	Country	TC	TP	TH	TC/TP	>250	>100	>50	ARWU	QS
1	Islamic Azad U	Iran	1952	146	23	13,37	0	1	6	-	-
2	Indian Institute Technology	India	1412	133	19	10,62	0	2	6	-	-
3	National Cheng Kung U	China	969	96	17	10,09	0	0	2	301-400	224
4	Amirkabir U Technology	Iran	1227	76	18	16,14	0	1	5	-	-
5	Dalian U Technology	China	627	73	15	8,59	0	0	0	301-400	-
6	U Tehran	Iran	1322	72	19	18,36	0	1	7	201-300	651-700
7	Iran U Science Technology	Iran	918	70	16	13,11	0	0	3	-	-
8	CSIRO	Australia	1387	69	18	20,10	1	2	7	-	-
9	Xi An Jiaotong U	China	630	64	14	9,84	0	0	1	201-300	331
10	CNRS	France	531	60	11	8,85	0	0	1	-	-
11	Sharif U Technology	Iran	673	59	16	11,41	0	0	1	401-500	601-650
12	Huazhong U Science Tech	China	617	54	14	11,43	0	0	2	201-300	441-450

13	U Greenwich	UK	765	51	18	15,00	0	0	3	-	701+
14	Harbin Institute Technology	China	354	51	11	6,94	0	0	0	151-200	291
15	Chinese Academy Sciences	China	416	46	11	9,04	0	0	1	-	-
16	Cairo U	Egypt	450	45	11	10,00	0	1	2	401-500	501-550
17	National Technical U Athens	Greece	439	44	12	9,98	0	0	0	-	376
18	Swansea U	UK	210	44	8	4,77	0	0	0	-	400
19	Tongji U	China	385	43	11	8,95	0	0	1	301-400	345
20	Hunan U	China	446	42	12	10,62	0	0	1	-	-
21	Shanghai Jiao Tong U	China	395	41	11	9,63	0	0	3	101-150	70
22	Hong Kong Polytechnic U	China	501	40	15	12,53	0	0	0	301-400	162
23	Northwestern Polytechnical U	China	271	39	9	6,95	0	0	0	-	-
24	U Manchester	UK	230	39	7	5,90	0	0	0	41	33
25	Shenyang Aerospace U	China	611	37	15	16,51	0	0	1	-	-
26	Ferdowsi U Mashhad	Iran	311	35	11	8,89	0	0	1	-	-
27	Lanzhou U	China	222	34	9	6,53	0	0	0	301-400	601-650
28	Isfahan U Technology	Iran	332	33	11	10,06	0	0	1	-	-
29	Tsinghua U	China	341	32	10	10,66	0	0	0	58	25
30	US Dep Energy	USA	323	32	8	10,09	0	0	1	-	-
31	National Taiwan U	China	137	32	7	4,28	0	0	0	151-200	70
32	Southeast U China	China	679	31	13	21,90	0	2	4	301-400	461-470
33	Queensland U Technology	Australia	651	31	14	21,00	0	2	2	401-500	263
34	U New South Wales Sydney	Australia	363	31	10	11,71	0	0	2	101-150	46
35	Beijing Jiaotong U	China	306	30	8	10,20	0	0	0	-	-
36	Central South U	China	230	30	10	7,67	0	0	0	301-400	-
37	U Waterloo	Canada	229	30	9	7,63	0	0	0	201-300	152
38	U Wollongong	Australia	476	29	11	16,41	0	1	2	201-300	243
39	National Taiwan U Sci Tech	China	298	29	10	10,28	0	0	1	-	260
40	King Fahd U Petroleum Minerals	S. Arabia	243	29	8	8,38	0	0	0	401-500	199
41	King Abdulaziz U	S. Arabia	504	28	9	18,00	0	1	4	151-200	303
42	Indian Institute Tech Kharagpur	India	490	28	11	17,50	0	1	3	-	286
43	McGill U	Canada	465	28	13	16,61	0	0	2	64	24
44	Nanjing U Aeronautics Astronautics	China	390	28	11	13,93	0	1	1	201-300	130
45	Shiraz Univ	Iran	329	28	11	11,75	0	0	0	-	-
46	Indian Institute Tech Delhi	India	263	28	9	9,39	0	0	1	-	179
47	Jiangnan U	China	743	27	15	27,52	0	1	4	-	-
48	Ryerson U	Canada	298	27	12	11,04	0	0	0	-	701+
49	Tarbiat Modares U	Iran	289	27	10	10,70	0	0	1	-	-
50	Zhejiang U	China	289	27	9	10,70	0	0	0	101-150	110

Abbreviations: GERAD = Groupe d'etudes et de recherche en analyse des decisions.

Table 8: Temporal analysis of 40 most contributing institutions

R	University	TC	TP	R	University	TC	TP
	1976-1981				2002-2006		
1	U Southampton	224	9	1	CSIRO	632	14
2	Cairo U	19	7	2	National Cheng Kung U	130	12
3	Virginia Polytechnic Institute State U	16	6	3	U Greenwich	194	9
	1982-1986			4	U Melbourne	172	8
1	U Sunderland	75	11	5	National Technical U Athens	88	8
2	U Southampton	297	8	6	Hong Kong Polytechnic U	97	7
3	Cairo U	8	7	7	King Saud U	88	7
4	Slovak Academy Sciences	217	6		2007-2011		
5	U Greenwich	141	6	1	Islamic Azad U	775	35
6	Loughborough U	41	6	2	Indian Institute Technology	634	28

7	U Liverpool	38	6
8	Swansea U	25	6
9	King Fahd U Petroleum Minerals	18	6
10	Virginia Polytechnic Institute State U	12	6
11	US Department of Defense	7	6
12	U Bologna	6	6
	1987-1991		
1	U Greenwich	162	12
2	King Fahd U Petroleum Minerals	129	10
3	U Waterloo	51	7
4	U Manchester	49	7
5	Rensselaer Polytechnic Institute	44	7
6	Clarkson U	40	7
7	Alexandria U	26	7
8	CSIRO	122	6
9	National Technical U Athens	73	6
10	U Bradford	8	6
	1992-1996		
1	U Wollongong	183	11
2	U Greenwich	123	11
3	National Cheng Kung U	94	10
4	National Technical U Athens	98	8
5	Cairo U	56	6
6	Indian Institute Technology	43	6
7	US Department Agriculture	40	6
	1997-2001		
1	CSIRO	360	14
2	U Bradford	115	10
3	National Cheng Kung U	192	9
4	Indian Institute Technology	146	9
5	U New South Wales Sydney	148	7
6	U Greenwich	124	7
7	Hong Kong Polytechnic U	89	7
8	Kuwait U	70	7
9	National Taiwan U	44	7
10	National Technical U Athens	57	6
3	National Cheng Kung U	372	28
4	Xi An Jiaotong U	380	24
5	Amirkabir U Technology	656	23
6	Dalian U Technology	298	23
7	U Tehran	458	20
8	Iran U Science Technology	422	19
9	Sharif U Technology	332	17
10	Chinese Academy Sciences	247	17
11	Huazhong U Science Technology	279	16
12	Natl Taichung Inst Tech	196	16
	2012-2016		
1	Islamic Azad U	1171	110
2	Indian Institute Technology	440	72
3	U Tehran	864	52
4	Iran U Science Technology	496	51
5	Amirkabir U Technology	463	49
6	Dalian U Technology	302	48
7	Sharif U Technology	287	39
8	Xi An Jiaotong U	240	38
9	Harbin Institute Technology	138	34
10	National Cheng Kung U	157	32
11	CNRS	94	30
12	Tongji U	151	29
13	Huazhong U Science Technology	234	28
14	Ferdowsi U Mashhad	206	28
15	Northwestern Polytechnical U	160	27
16	Chinese Academy Sciences	124	27
17	Hunan U	139	26
18	Shenyang Aerospace University	300	25
19	Lanzhou University	126	25
20	King Abdulaziz University	387	24
21	Univ Guilan	198	23
22	Shanghai Jiao Tong University	126	23
23	Swansea University	93	23
24	Ryerson University	189	22
25	Beijing Jiaotong University	183	22

A further interesting issue is to analyze the country affiliation of the institutions where the authors are publishing their research in AMM. Tables 9, presents the 50 most productive and influential countries in the journal. This study uses similar indicators to those in the university analysis for the country analysis. This analysis also considers the total population of the country to see the productivity per million of inhabitants.

China is the most productive and influential country in the journal. Iran obtains the second position in terms of papers published in the journal followed by the USA. Pakistan has a maximum number of cites per paper. As per capita production and influence, Australia obtains first position in the list. In total, the journal is very diverse with countries and researchers from all over the world publishing in Applied Mathematical Modelling.

Next, let us examine the productivity of countries over time. Table 10 presents the temporal evolution of the publications of the 40 countries that appeared in Table 9. Note that the documents published before 1997 are summarized in a single result.

During the first years of the journal, The USA and the UK were the most productive institutions in the AMM. In 2006, Australia published a maximum number of documents in the journal. However, since 2007, China has become the most productive country and published total 1945 documents. In 2016, Iran has published more papers in comparison to the USA and the UK. Note that Brazil is the only country from South America who obtained a place in top 40.

Table 9: The most productive and influential countries in AMM

R	Country	TC	TP	TH	TC/TP	>250	>100	>50	Population (miles)	TC/Pop	TP/Pop
1	China	21520	1945	53	11,06	0	10	60	1.414.542.348	1,521	0,138
2	USA	7323	837	37	8,75	0	4	17	325.091.000	2,253	0,257
3	Iran	8438	691	39	12,21	0	4	26	80.189.400	10,523	0,862
4	UK	5288	592	34	8,93	0	1	14	65.110.000	8,122	0,909
5	India	4961	450	31	11,02	0	3	17	1.316.960.000	0,377	0,034
6	Australia	4410	314	31	14,04	1	6	16	24.484.100	18,012	1,282
7	Canada	2539	275	24	9,23	0	0	7	36.562.500	6,944	0,752
8	Egypt	2389	196	25	12,19	0	3	6	93.142.100	2,565	0,210
9	Turkey	2431	191	26	12,73	0	2	8	79.814.871	3,046	0,239
10	France	1368	168	19	8,14	0	0	3	67.032.000	2,041	0,251
11	Spain	1387	167	20	8,31	0	0	2	46.812.000	2,963	0,357
12	Italy	876	159	15	5,51	0	0	0	60.599.936	1,446	0,262
13	Brazil	799	133	15	6,01	0	0	1	207.586.000	0,385	0,064
14	Saudi Arabia	1195	113	18	10,58	0	1	4	34.005.000	3,514	0,332
15	South Korea	1119	112	16	9,99	0	1	3	51.446.201	2,175	0,218
16	Japan	873	111	15	7,86	0	0	2	126.730.000	0,689	0,088
17	Greece	842	87	17	9,68	0	0	0	10.783.748	7,808	0,807
18	Germany	893	107	15	8,35	0	1	1	82.800.000	1,079	0,129
19	Poland	519	79	12	6,57	0	0	2	38.424.000	1,351	0,206
20	South Africa	598	64	13	9,34	0	0	2	55.908.000	1,070	0,114
21	Russia	264	55	9	4,80	0	0	0	146.804.372	0,180	0,037
22	Mexico	539	55	12	9,80	0	1	1	123.518.000	0,436	0,045
23	Pakistan	841	47	17	17,89	0	1	1	197.464.000	0,426	0,024
24	Malaysia	401	47	12	8,53	0	0	0	32.090.700	1,250	0,146
25	Netherlands	507	44	12	11,52	0	0	2	17.127.900	2,960	0,257
26	Belgium	395	41	10	9,63	0	0	2	11.356.191	3,478	0,361
27	Portugal	248	37	9	6,70	0	0	0	10.341.330	2,398	0,358

28	Singapore	525	34	12	15,44	0	1	3	5.607.300	9,363	0,606
29	Norway	161	31	7	5,19	0	0	0	5.267.146	3,057	0,589
30	Romania	419	29	10	14,45	0	0	2	19.760.000	2,120	0,147
31	Kuwait	240	28	9	8,57	0	0	0	4.183.658	5,737	0,669
32	Tunisia	110	26	6	4,23	0	0	0	11.299.400	0,974	0,230
33	U Arab Emirates	255	25	8	10,20	0	0	1	10.139.000	2,515	0,247
34	Switzerland	194	23	8	8,43	0	0	0	8.417.700	2,305	0,273
35	Algeria	430	25	10	17,20	0	1	3	41.064.000	1,047	0,061
36	Sweden	91	23	4	3,96	0	0	0	10.042.200	0,906	0,229
37	Denmark	301	23	9	13,09	0	1	1	5.756.170	5,229	0,400
38	Israel	252	22	6	11,45	0	0	2	8.698.640	2,897	0,253
39	Morocco	166	21	7	7,90	0	0	1	34.338.700	0,483	0,061
40	Vietnam	174	20	6	8,70	0	0	1	92.700.000	0,188	0,022
41	Serbia	428	31	7	13,81	0	2	2	7.076.372	6,048	0,438
42	Bulgaria	125	19	5	6,58	0	0	1	7.101.859	1,760	0,268
43	Hungary	81	18	6	4,50	0	0	0	9.799.000	0,827	0,184
44	Finland	184	18	7	10,22	0	0	0	5.503.879	3,343	0,327
45	Chile	117	18	7	6,50	0	0	0	18.191.900	0,643	0,099
46	Oman	134	17	6	7,88	0	0	0	4.573.075	2,930	0,372
47	New Zealand	100	17	6	5,88	0	0	0	4.791.040	2,087	0,355
48	Argentina	71	17	4	4,18	0	0	0	43.850.000	0,162	0,039
49	Nigeria	57	15	5	3,80	0	0	0	191.836.000	0,030	0,008
50	Lebanon	118	15	7	7,87	0	0	0	5.988.000	1,971	0,251

Table 10: Annual number of publications in AMM by countries

R	Country	Pre1997	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Total
1	China	66	6	9	10	14	12	8	12	12	15	20	57	65	160	150	207	192	276	185	222	247	1945
2	USA	382	16	11	11	20	15	7	12	16	12	9	23	18	24	19	25	36	55	36	32	58	837
3	Iran	1	2	0	0	1	1	0	4	1	2	4	14	13	27	48	71	103	148	73	82	96	691
4	UK	304	21	13	4	12	4	12	9	5	7	12	11	13	16	5	12	15	41	18	19	39	592
5	India	50	4	2	6	4	3	4	3	3	9	3	11	20	34	37	32	36	74	38	32	45	450
6	Australia	82	3	17	4	11	5	13	5	4	4	22	4	5	7	7	13	8	17	32	12	39	314
7	Canada	91	1	3	1	3	4	4	3	4	1	6	10	6	11	12	18	17	27	11	16	26	275
8	Egypt	44	2	0	1	1	1	0	3	2	3	2	8	13	12	11	12	14	31	8	9	19	196
9	Turkey	7	2	1	1	3	2	2	2	0	5	3	11	11	9	17	16	19	29	9	22	20	191
10	France	23	1	1	4	4	3	2	1	2	0	9	3	5	7	7	13	15	16	8	19	25	168
11	Spain	18	4	4	1	1	4	3	1	1	1	7	11	4	8	3	10	14	11	17	18	26	167
12	Italy	61	1	1	4	1	1	1	0	0	0	2	3	1	4	8	8	6	12	9	17	19	159
13	Brazil	60	1	1	4	1	1	1	0	0	0	2	3	1	4	8	8	6	12	9	17	19	158
14	Saudi Arabia	23	0	0	1	0	1	1	4	2	2	1	2	4	3	3	8	7	16	11	9	15	113
15	South Korea	6	0	1	1	0	0	1	1	0	2	1	7	2	8	9	9	11	20	9	13	11	112
16	Japan	39	2	2	0	0	4	3	0	1	1	3	2	3	6	5	4	7	11	6	8	4	111
17	Greece	31	0	2	2	2	2	3	3	5	2	2	3	4	4	3	3	3	5	3	3	2	87
18	Germany	29	1	2	1	1	1	1	1	3	3	1	4	7	3	3	9	2	7	9	5	14	107
19	Poland	17	1	0	0	1	0	1	0	1	0	0	3	2	7	2	2	4	11	4	11	12	79
20	South Africa	28	0	1	2	0	0	0	4	0	1	1	1	3	5	1	1	3	3	1	4	5	64
21	Russia	5	2	0	2	0	0	1	0	0	2	0	1	4	6	3	0	2	7	4	6	10	55
22	Mexico	8	0	0	0	0	0	0	0	0	0	0	1	0	3	4	4	4	11	4	8	8	55
23	Pakistan	0	1	1	0	0	0	0	0	1	0	0	0	3	7	3	3	4	12	4	1	7	47
24	Malaysia	0	0	0	0	0	0	0	0	0	0	0	0	1	4	2	5	7	11	4	6	7	47
25	Netherlands	11	1	1	1	0	0	4	0	0	0	1	1	1	4	1	2	1	4	5	0	6	44
26	Belgium	11	0	2	0	1	0	1	0	0	1	2	0	2	1	1	2	2	5	2	1	7	41
27	Portugal	7	1	0	1	0	0	1	0	0	0	0	3	2	2	0	3	1	5	2	5	4	37
28	Singapore	2	0	0	1	1	0	0	1	1	1	0	2	0	0	4	0	2	5	3	3	8	34
29	Norway	12	0	0	0	0	0	0	0	2	0	0	1	1	2	1	2	2	5	0	0	3	31
30	Romania	0	0	0	0	0	0	0	0	0	0	1	2	2	1	3	4	1	5	1	5	4	29
31	Kuwait	13	4	0	1	2	0	0	1	0	0	1	0	1	0	1	0	1	2	0	0	1	28
32	Tunisia	0	0	0	0	2	1	1	0	0	0	0	1	2	1	0	0	2	4	2	3	7	26
33	U Arab Emirates	0	1	0	1	0	0	0	1	0	0	0	1	3	2	2	1	1	3	2	1	6	25
34	Switzerland	3	0	2	0	0	0	0	1	0	1	0	1	1	2	0	4	0	1	3	3	3	25
35	Algeria	0	0	0	0	0	0	0	1	0	0	1	1	0	2	2	3	4	3	0	4	4	25
36	Sweden	8	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	1	1	5	0	5	23
37	Denmark	9	0	0	0	1	0	0	1	0	0	0	1	1	1	2	1	0	0	2	2	2	23
38	Israel	8	0	1	0	0	1	0	0	0	0	1	0	1	1	1	1	1	1	1	0	4	22
39	Morocco	1	0	0	0	0	0	1	0	0	0	0	0	0	2	3	0	1	5	4	0	4	21
40	Vietnam	2	0	0	0	0	0	1	0	0	0	0	0	0	2	3	0	1	5	4	0	4	20

4. Mapping AMM with VOS viewer software

The previous section provides a general overview of the leading and influential variables in the journal. This section develops a graphical analysis of bibliometric connections between leading sources and trends to provide a deeper analysis of the publication structure. The VOS viewer [14] is freely available software which collects the bibliometric data for analysis and visualization by using several bibliometric indicators including bibliometric coupling [15], citation [5], co-citation analysis [16], co-authorship [12] and co-occurrence of keywords [4]. The VOS viewer is particularly useful for displaying large bibliometric maps in easily interpreted ways. First, let us analyze co-citation of journals of documents published in AMM. Recall that co-citation is defined as the frequency with which the two documents published in different journals receive a citation from a document of another journal. Fig. 2 shows the results with a threshold of one hundred citations and the one hundred most representative connections.

As we see, Applied Mathematical Modelling itself is the most cited journal followed by European Journal of Operational Research. Numerical and computational mathematics related journals are most influential ones including Journal of Computational and Applied Mathematics, International Journal of Numerical Methods and Engineering, Journal of Computational Physics, International Journal of Heat and Mass Transfer, International Journal of Numerical Methods in Fluids and Journal of Fluid Mechanics. Note that Journal of Sound and Vibration has a strong influence in the journal. In order to analyze the citation evolvement through time, Fig. 3-5 present the co-citation of journals between 1987-1996, 1997-2006, and 2007-2016. Note that the threshold values for these figures are 20, 20 and 10, respectively and co-citation networks are one hundred links for each one. Note that the self-citations of Applied Mathematical Modelling dominate in all the figures and have been increasing over time.

To analyze these results more deeply, Table 11 presents the details of forty most cited journals in Applied Mathematical Modelling considering the total results and three ten year periods 1987-1996, 1997-2006 and 2007-2016 in order to see the evolution of the influence of each journal through time.

The results show the strong influence of Applied Mathematical Modelling through time followed by European Journal of Operational Research. Many other journals including

Applied Mathematics and Computation, Journal of Sound and Vibration and Journal of Computational Physics have shown remarkable presence in the last ten years.

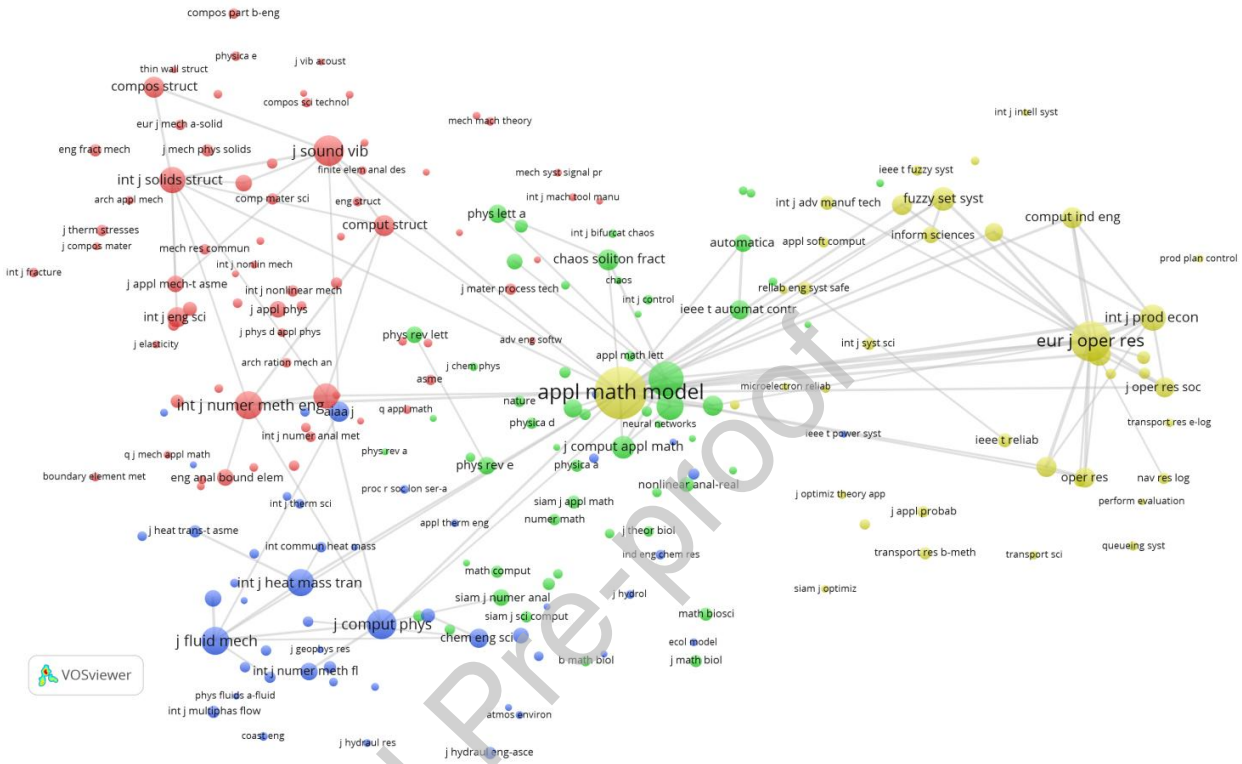

Figure 2: Co-citation of journals in AMM

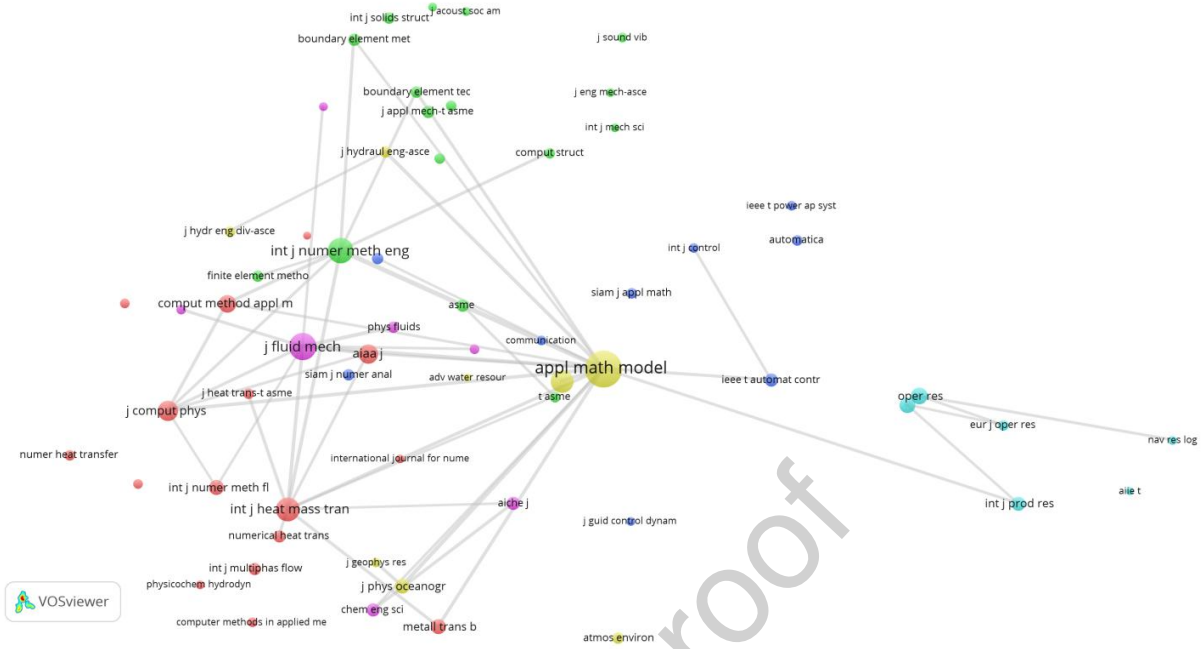

Figure 3: Co-citation of journals in AMM: 1987-1996

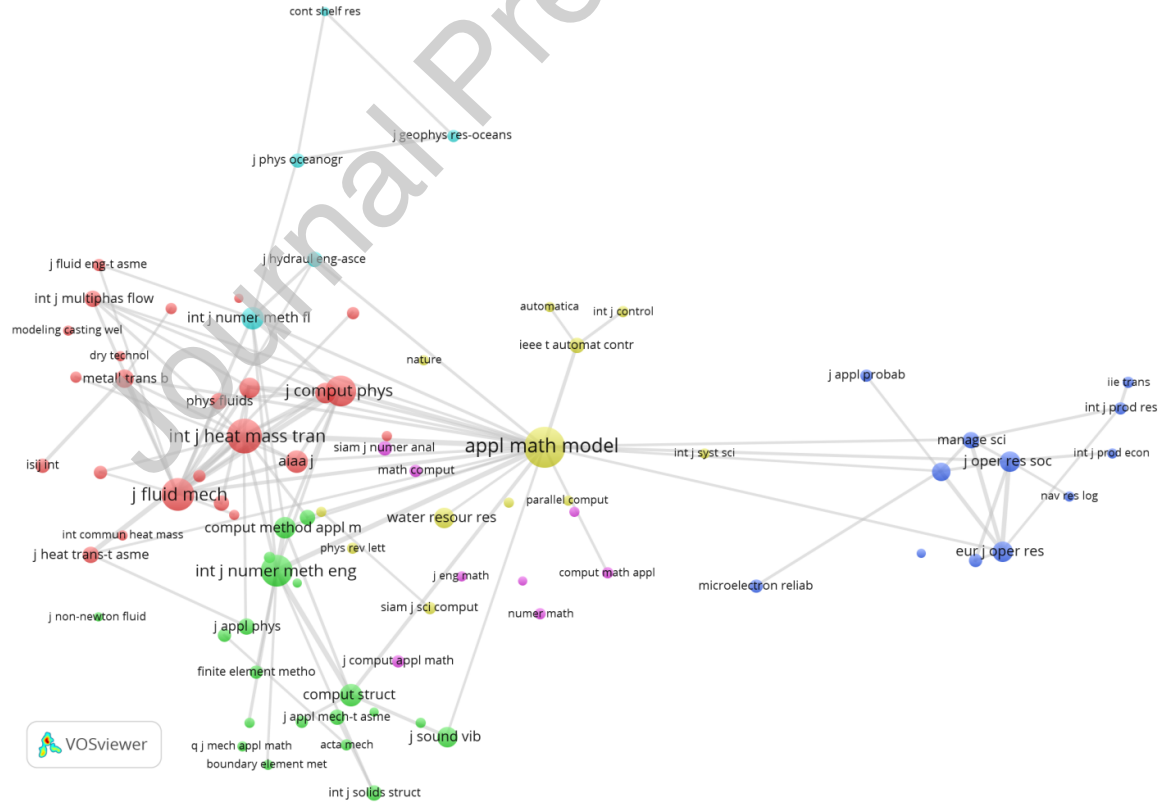

Figure 4: Co-citation of journals in AMM: 1997-2006

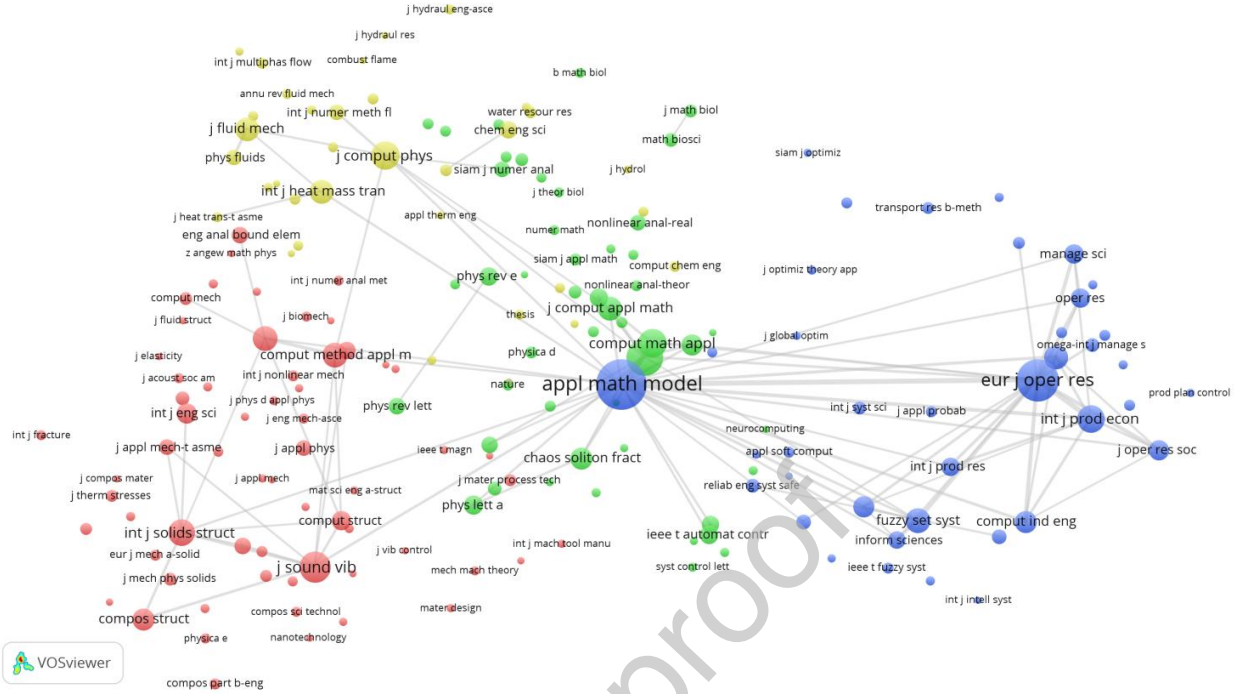

Figure 5: Co-citation of journals in AMM: 2007-2016

Table 11: Co-citation of journals in AMM: Global and temporal analysis.

	Global			1987-1996			1997-2006			2007-2016		
R	Journal	Cit	CLS	Journal	Cit	CLS	Journal	Cit	CLS	Journal	Cit	CLS
1	Appl Math Model	5215	4185.94	Appl Math Model	358	239.78	Appl Math Model	347	266.23	Appl Math Model	4371	3749.99
2	Eur J Oper Res	3182	2447.01	J Fluid Mech	198	138.50	Int J Heat Mass Tran	246	165.13	Eur J Oper Res	3062	2395.75
3	Appl Math Comput	2319	1909.92	Int J Numer Meth Eng	175	137.85	J Fluid Mech	215	168.79	Appl Math Comput	2287	1931.54
4	J Sound Vib	1825	1184.81	Int J Heat Mass Tran	148	107.59	Int J Numer Meth Eng	211	152.91	J Sound Vib	1714	1210.10
5	J Comput Phys	1756	1283.45	Water Resour Res	138	51.23	J Comput Phys	190	130.12	J Comput Phys	1422	1091.50
6	Int J Numer Meth Eng	1511	1202.19	J Comput Phys	111	86.83	Int J Numer Meth Fl	106	89.30	Comput Math Appl	1392	1198.77
7	J Fluid Mech	1488	1073.10	AIAA J	100	84.92	AIAA J	105	86.46	Int J Prod Econ	1360	1103.11
8	Comput Math Appl	1443	1217.51	Comput Method Appl M	84	69.23	Comput Struct	103	80.74	Int J Solids Struct	1238	1068.67
9	Int J Heat Mass Tran	1407	950.28	Oper Res	80	50.31	Comput Method Appl M	95	82.86	Comput Method Appl M	1059	912.44
10	Int J Prod Econ	1383	1107.99	Manage Sci	72	51.56	Eur J Oper Res	90	68.81	Int J Numer Meth Eng	1056	898.53
11	Int J Solids Struct	1351	1137.16	Int J Numer Meth Fl	65	53.95	Aiche J	89	77.68	Fuzzy Set Syst	1043	792.24
12	Comput Method Appl M	1261	1061.14	J Phys Oceanogr	63	38.70	Chem Eng Sci	89	71.80	Comput Oper Res	1029	918.46
13	Comput Oper Res	1083	957.54	Metall Trans B	62	35.85	Water Resour Res	89	27.60	J Fluid Mech	1001	757.70
14	Fuzzy Set Syst	1062	771.52	Int J Prod Res	55	25.86	J Oper Res Soc	88	60.45	J Comput Appl Math	977	899.95
15	J Comput Appl Math	1021	925.10	Chem Eng Sci	51	31.34	J Sound Vib	84	41.66	Int J Heat Mass Tran	971	727.60
16	Chaos Soliton Fract	866	704.55	IEEE T Automat Contr	49	30.33	Oper Res	70	52.56	Chaos Soliton Fract	859	716.95
17	Comput Ind Eng	848	776.06	Aiche J	47	35.62	Metall Trans B	68	50.65	Compos Struct	837	689.23
18	Compos Struct	845	664.30	Numerical Heat Trans	45	41.00	Phys Fluids	60	53.69	Comput Ind Eng	836	770.18
19	Comput Struct	839	729.18	J Appl Mech-T Asme	44	35.31	Int J Multiphas Flow	58	49.37	Expert Syst Appl	801	654.26
20	Oper Res	817	692.24	Asme	43	31.74	J Appl Phys	58	37.30	Math Comput Model	770	730.78
21	Expert Syst Appl	801	629.81	Boundary Element Met	41	32.48	Manage Sci	58	49.27	Int J Eng Sci	723	632.47
22	Int J Eng Sci	796	672.30	Int J Multiphas Flow	40	26.11	J Heat Trans-T Asme	56	48.07	J Oper Res Soc	691	613.65
23	J Oper Res Soc	792	681.85	Int J Solids Struct	39	32.26	Asme	53	40.78	Comput Struct	689	621.17
24	Math Comput Model	792	742.32	Atmos Environ	38	5.00	J Appl Mech-T Asme	53	44.75	Phys Lett A	658	568.81
25	AIAA J	788	603.10	Boundary Element Tec	37	33.49	J Hydraul Eng-Asce	52	38.37	Oper Res	649	582.62
26	Manage Sci	781	669.63	Finite Element Metho	37	32.53	IEEE T Automat Contr	50	31.18	Manage Sci	638	562.90
27	IEEE T Automat Contr	733	487.14	Siam J Numer Anal	36	33.13	Int J Solids Struct	49	43.20	J Math Anal Appl	625	559.26
28	Chem Eng Sci	708	492.29	Phys Fluids	35	31.50	Powder Technol	48	36.96	IEEE T Automat Contr	620	474.71
29	Int J Prod Res	685	555.11	J Hydraul Eng-Asce	34	25.31	Isij Int	44	29.73	Int J Prod Res	599	509.48
30	J Math Anal Appl	671	585.11	Math Comput	34	23.44	Siam J Numer Anal	44	39.06	Phys Rev E	596	491.10
31	Phys Lett A	665	558.60	Comput Struct	33	28.89	J Phys Oceanogr	43	28.23	Inform Sciences	566	499.33
32	Int J Numer Meth Fl	630	549.65	J Heat Trans-T Asme	32	27.38	Comput Oper Res	38	33.56	Chem Eng Sci	559	406.48
33	Phys Rev E	608	482.90	Siam J Appl Math	31	22.80	Finite Element Metho	37	33.40	AIAA J	541	423.30
34	Automatica	581	439.92	Int J Eng Sci	30	21.84	Numerical Heat Trans	37	36.00	Automatica	519	430.28
35	Inform Sciences	573	495.42	J Appl Mech	30	21.10	Int J Eng Sci	36	31.43	Commun Nonlinear Sci	514	474.33
36	J Appl Mech-T Asme	551	499.16	J Hydr Eng Div-Asce	30	22.78	Microelectron Reliab	36	22.32	Eng Anal Bound Elem	500	412.39
37	Eng Anal Bound Elem	546	440.02	Automatica	29	11.71	J Comput Appl Math	35	26.10	Phys Rev Lett	486	436.38
38	Phys Fluids	546	485.11	Eur J Oper Res	29	22.66	Numer Heat Tr B-Fund	35	32.47	Int J Mech Sci	484	446.24
39	J Appl Phys	540	434.70	Numer Heat Transfer	29	25.14	J Appl Probab	34	22.79	J Appl Phys	457	405.06
40	Siam J Numer Anal	540	470.95	T Asme	29	23.20	Annu Rev Fluid Mech	33	31.91	Int J Numer Meth Fl	451	413.24

Abbreviations: Cit = Citations; CLS = Citation link strength.

Next, let us look into the bibliographic coupling of institutions publishing in AMM. Fig 6 shows the one hundred strongest bibliographic coupling links between institutions publishing in AMM based on a threshold of ten published documents.

The results of this figure are in accordance with those of Table 7. The Islamic Azad University is the most productive institution in the journal. Indian Institute of Technology, University of Tehran, National Cheng-Kung University and the Amirkabir University of Technology also have a significant position in the graph.

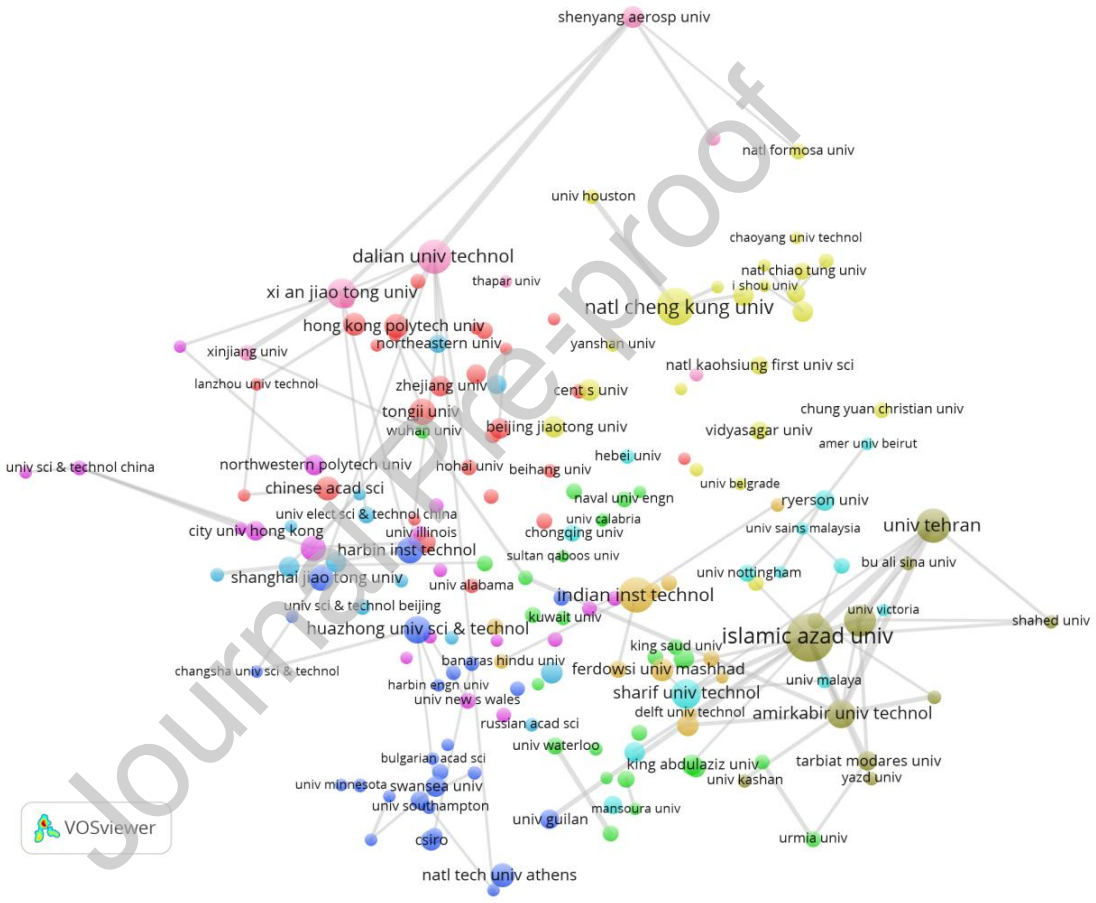

Figure 6: Bibliographic coupling of institutions publishing in AMM

Another interesting issue is to consider the citation analysis of the institutions publishing in the journal. Here, the network visualizes the institutions that cite each other more. Fig. 7 presents the results.

The results are equivalent to the results displayed in Fig.6. Note that it is very common that the universities from the same country or region cite each other much more than with foreign institutions. Islamic Azad University, National Cheng-Kung University, Delian University of Technology and Xi'an Jiaotong University are connected more strongly with other institutions.

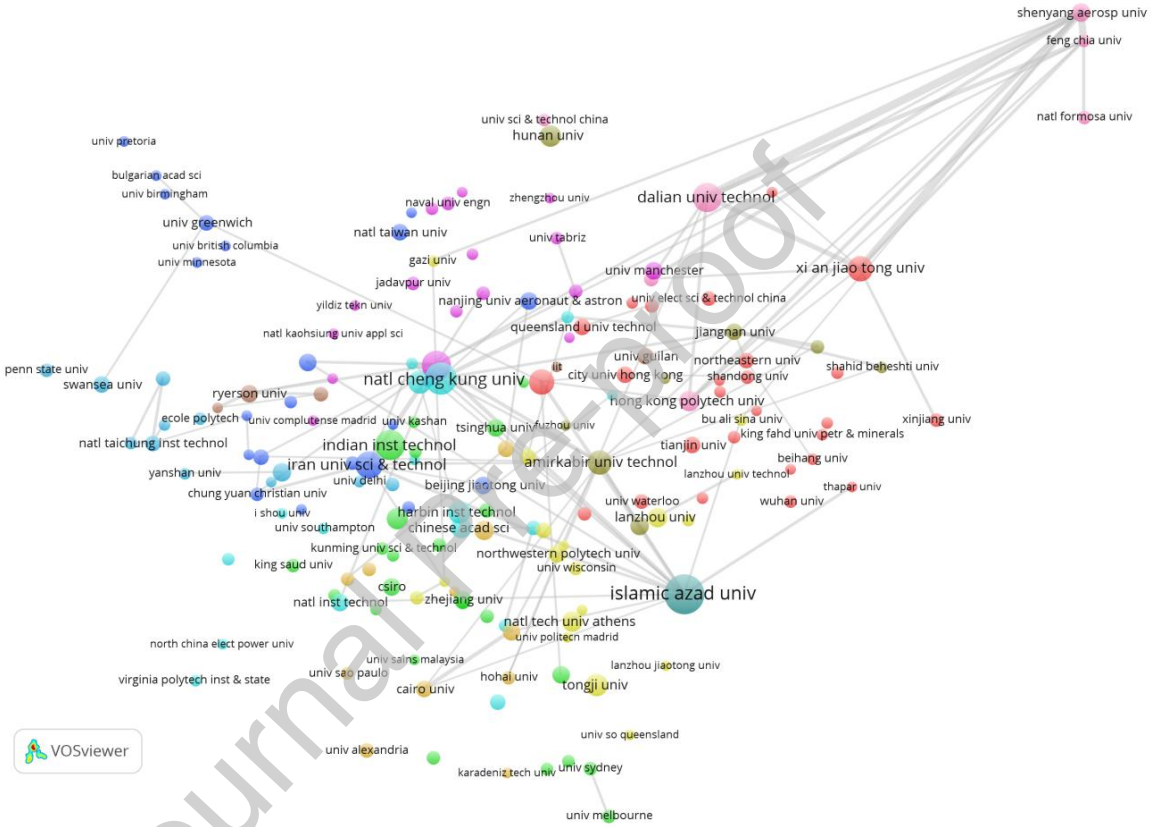

Figure 7: Citation analysis of institutions publishing in AMM

A further interesting issue is to analyse co-authorship between countries in order to identify the main co-authoring countries in the journal. Fig. 8 shows the results considering a threshold of five documents and the fifty strongest bibliographic connections.

China is the most productive country followed by Taiwan, India, USA, and Iran. The authors from these countries are significantly connected to each other. Canada, England, and Australia also show a remarkable position in the graph.

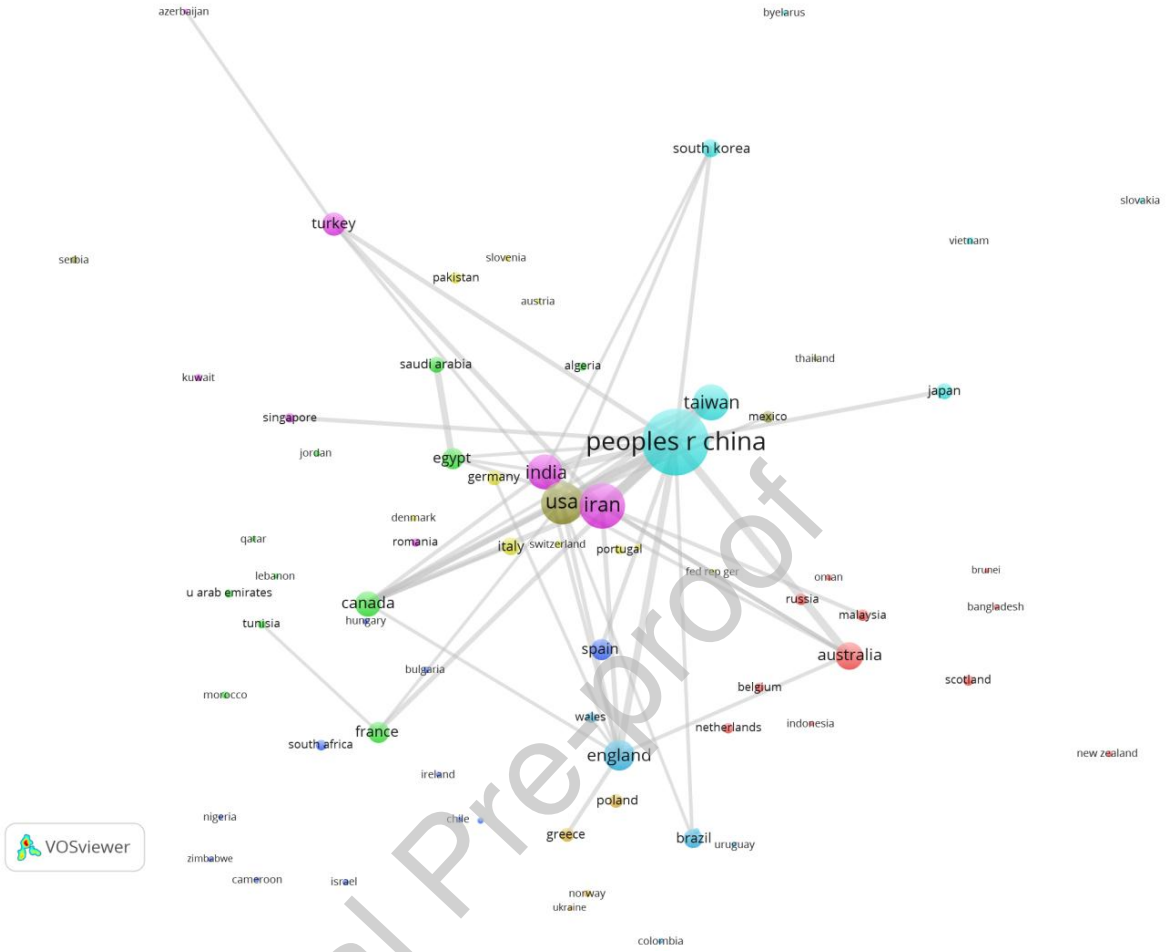

Figure 8: Bibliographic coupling of countries publishing in AMM

Finally, let us analyze the most common keywords used by authors to characterize their papers. For doing so, the work considers co-occurrence of author keywords visualization with VOS viewer software. Fig. 9 visualizes the map considering a threshold of ten occurrences and the one hundred most representative connections.

Stability, optimization, inventory, numerical simulation, finite element method, scheduling, and genetic algorithms are the most common keywords in the journal. Further, in order to see the how the use of these keywords is evolving through time, Table 12 presents a list of the Top 40 occurrences of the author keywords divided into three periods: 1987-1996, 1997-2006 and 2007-2016.

During the first years of the journal, boundary element method was the most frequent keyword used by authors but now it is placed at 37th position in the list. On the other hand,

stability, scheduling, and optimization have emerged as the most frequently used keywords in AMM documents in recent years.

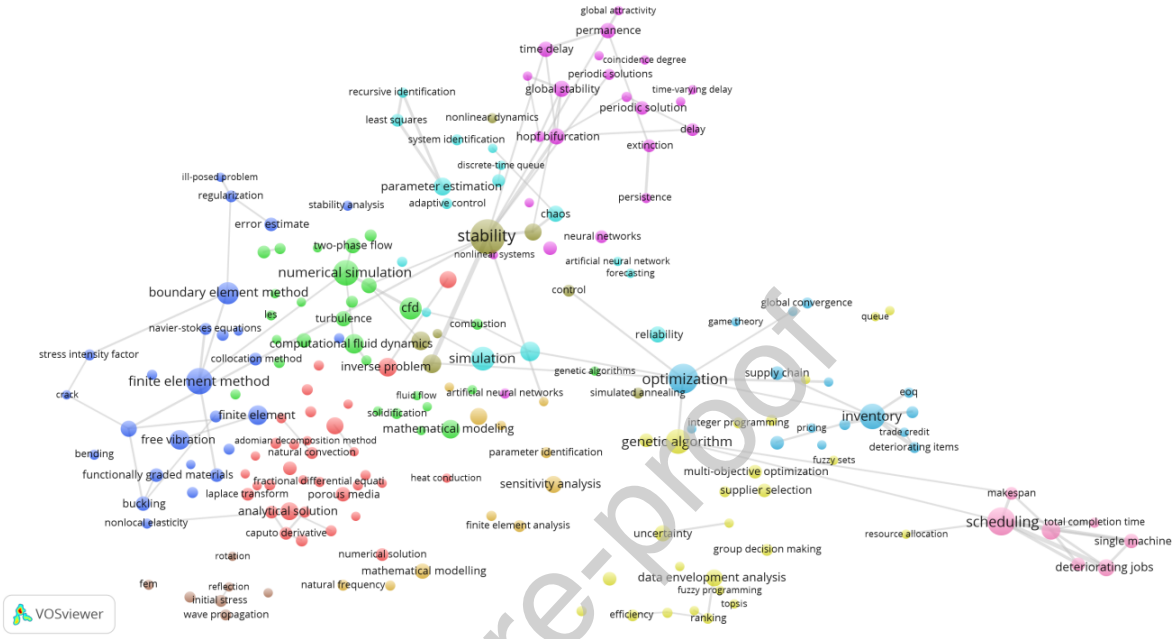

Figure 9: Co-occurrence of author keywords in AMM

Table 12: Co-occurrence of author keywords in AMM: Global and temporal analysis

	Global			1987-1996			1997-2006			2007-2016		
R	Keyword	Occ	Co-oc	Keyword	Occ	Co-oc	Keyword	Occ	Co-oc	Keyword	Occ	Co-oc
1	Stability	137	81	Boundary Element Method	21	5	CFD	15	8	Stability	129	71
2	Optimization	99	49	Optimization	16	8	Numerical Simulation	13	6	Scheduling	85	68
3	Scheduling	86	69	Finite Elements	10	6	Finite Element Method	12	5	Optimization	71	33
4	Finite Element Method	77	33	Simulation	10	5	Optimization	12	5	Genetic Algorithm	64	27
5	Inventory	74	40	Mathematical Model	7	2	Simulation	12	8	Finite Element Method	61	24
6	Numerical Simulation	74	35	Mathematical Modeling	7	4	Computational Fluid Dynamics	11	4	Inventory	60	31
7	Genetic Algorithm	67	28	Finite Element	6	3	Boundary Element Method	10	3	Numerical Simulation	57	24
8	Simulation	62	29	Fluid Flow	6	3	Modelling	9	4	Learning Effect	41	37
9	CFD	54	19	Inventory	6	4	CFD Modelling	8	3	Free Vibration	40	18
10	Boundary Element Method	53	16	Optimal Control	6	2	Inventory	8	4	Simulation	40	11
11	Computational Fluid Dynamics	43	18	Boundary Element	5	1	Mathematical Modelling	8	2	Modeling	35	16
12	Finite Element	42	18	CFD	5	1	Two-Phase Flow	8	6	CFD	34	9
13	Free Vibration	42	20	Computational Fluid Dynamics	5	1	Control	7	5	Analytical Solution	33	14
14	Modeling	42	24	Diffusion	5	2	Finite Elements	7	2	Convergence	33	20
15	Learning Effect	41	37	Mathematical Programming	5	1	Mathematical Model	7	5	Deteriorating Jobs	32	32
16	Convergence	38	24	Numerical Methods	5	0	Mathematical Modeling	7	2	Inverse Problem	32	10
17	Inverse Problem	38	14	Water Quality	5	3	Mixing	7	5	Data Envelopment Analysis	31	8
18	Mathematical Model	38	16	BEM	4	0	Turbulence	7	3	Finite Element	30	14
19	Mathematical Modeling	38	15	Control	4	3	Finite Element	6	2	Global Stability	30	23
20	Parameter Estimation	36	25	Control Volume	4	3	Heat Transfer	6	3	Bifurcation	29	19
21	Analytical Solution	35	16	Convection	4	4	Queue	6	4	Hopf Bifurcation	29	23
22	Heat Transfer	34	20	Drying	4	4	Vibration	6	1	Parameter Estimation	29	19
23	Optimal Control	34	13	Finite Element Method	4	4	Inverse Problem	5	0	Uncertainty	29	11
24	Data Envelopment Analysis	33	10	Goal Programming	4	1	Blast Furnace	4	4	Computational Fluid Dynamics	27	14
25	Modelling	33	16	Graph Theory	4	2	Continuous Casting	4	3	Optimal Control	27	9
26	Bifurcation	32	23	Modeling	4	3	Data Assimilation	4	0	Permanence	27	23
27	Deteriorating Jobs	32	32	Numerical	4	2	Deterioration	4	3	Reliability	26	6
28	Sensitivity Analysis	32	14	Numerical Modeling	4	2	Diffusion	4	2	Sensitivity Analysis	26	10
29	Chaos	30	16	Numerical Simulation	4	3	Dispersion	4	2	Heat Transfer	25	10
30	Global Stability	30	23	Parameter Estimation	4	2	Erosion	4	4	Time Delay	25	16
31	Reliability	30	7	Pipe Networks	4	3	Flow	4	2	Chaos	24	11
32	Uncertainty	30	14	Queue Length	4	3	Free Surface	4	0	Mathematical Model	24	9
33	Vibration	30	18	Sensitivity Analysis	4	3	M/G/1 Queue	4	2	Mathematical Modeling	24	7
34	Hopf Bifurcation	29	23	Stability	4	2	Microwave Heating	4	1	Modelling	24	6
35	Diffusion	28	15	Turbulence	4	2	Neural Network	4	1	Single Machine	23	22
36	Time Delay	28	16	2-Dimensional	3	2	Neural Networks	4	1	Vibration	23	14
37	Permanence	27	23	2-Phase Flow	3	1	Numerical Modeling	4	1	Boundary Element Method	22	6
38	Mathematical Modelling	26	4	Adaptive Control	3	1	Parallel Computing	4	2	Functionally Graded	22	8

											Materials		
39	Turbulence	26	15	Anisotropic Elasticity	3	2	Stability	4	1	Supply Chain	22	9
40	Two-Phase Flow	26	10	Annular Liquid Jets	3	0	Adsorption	3	3	Supply Chain Management	22	14

Abbreviations: Occ = Occurrences; Co-oc = Co-occurrence link strength

5. Conclusions

In 2016, AMM celebrated its fortieth anniversary. Motivated by this special occasion, the work presents a bibliometric analysis of the journal during this period in order to identify the most significant results occurring in the journal. The study uses the Web of Science Core Collection database to collect all the documents published in Applied Mathematical Modelling from 1976 to 2016. The results clearly show a strong growth and influence of the journal through time. Various bibliometric indicators are used to analyze the publication trends in AMM.

The work presents the leading institutions, countries, and authors of the journal. China is the most productive and influential country in the journal and its contribution has been increasing over time. Iran has obtained the second position in the journal followed by the USA. In terms of per capita, Australia is the most productive and influential country. The Islamic Azad University is the most productive and influential institution in AMM and has published 146 documents till December 2016. In recent years, India Institute of Technology, and the University of Tehran are making a remarkable contribution in AMM. Note that more than 70% most productive institutions are from Asia. Mark Cross from the UK is the most productive author whereas Paul W. Cleary from Australia is the most influential author in the journal. Some other authors have also published a notable number publication in the journal particularly Mohamad Y Jaber, Jauchuan Ke, Ji-bo Wang and Manoranjan K. Maiti.

Further, the study also develops a graphical visualization of the results with the help of VOS viewer software. The work shows the publication structure of authors, countries, and institutions, by considering bibliographic coupling, citation analysis, co-authorship, and co-occurrence of author keywords. The results are in accordance with those obtained in Section 3 where China is placed at the most significant position in the journal. The software also visualizes the most cited journals in AMM through co-citation analysis. The graph shows that most of the journals cited in AMM are related to applied and numerical mathematics, physics and operations research. The graphical study ends with an analysis of most frequent keywords and the co-occurrence with them. The leading topics of the journal are stability, optimization, inventory, numerical simulation, finite element method, scheduling, and genetic algorithms.

Note that the work provides a general overview of the publication and citation structure of Applied Mathematical Modelling by using a wide range of bibliometric indicators. By doing so, the study aims to represent the available data in a more informative way so that each reader can understand the data according to his interests and priorities. It is worth mentioning that the obtained results and trends can change over time because the bibliometric data is dynamic and may evolve differently in the future.

Acknowledgments

Financial support from the Chilean Government (Conicyt) through the Fondecyt Postdoctoral program (Project number-3170556) and Fondecyt Regular program (Project number-1160286) is thankfully acknowledged. We also thank the editors and reviewers for valuable comments that have improved the quality of the paper.

References

1. A.R. Ramos-Rodriguez, J. Ruiz-Navarro, Changes in the intellectual structure of strategic management research: a bibliometric study of the Strategic Management Journal, 1980-2000, Strategic Manage. J. 25(10) (2004) 981-1004.
2. M.J. Cobo, M.A. Martínez, M. Gutiérrez-Salcedo, H. Fujita, E. Herrera-Viedma, 25 years at Knowledge-Based Systems: a bibliometric analysis, Knowl-Based Syst. 80 (2015) 3-13.
3. C. Cancino, J.M. Merigó, F. Coronado, Y. Dessouky, M. Dessouky, Forty years of Computers and Industrial Engineering: a bibliometric analysis, Comput. Ind. Eng. 113 (2017) 614-629.
4. S. Laengle, J.M. Merigó, J. Miranda, R. Slowinski, I. Bomze, E. Borgonovo, R.G. Dyson, J.F. Oliveira, R. Teunter, Forty years of European Journal of Operation Research: a bibliometric overview, Eur. J. Oper. Res. 262(3) (2017) 803-816.
5. J.M. Merigó, W. Pedrycz, R. Weber, C. D. L. Sotta, Fifty years of Information Sciences: a bibliometric overview, Inf. Sci. 432 (2018) 245-268.
6. N.J. Van Eck, L. Waltman, Bibliometric mapping of the computational intelligence field, Int. J. Uncert. Fuzz. Knowl-Based Syst. 15(5) (2007) 625-645.

7. J.M. Merigó, A.M. Gil-Lafuente, R.R. Yager, An overview of fuzzy research with bibliometric indicators, Appl. Soft Comput. 27 (2015) 420-433.
8. D. Yu, S. Shi, Researching the development of Atanassov intuitionistic fuzzy set: using a citation network analysis, Appl. Soft Comput. 32 (2015) 189-198.
9. J.M. Merigó, J.B. Yang, A bibliometric overview of operations research and management science, Omega 73 (2017) 37-48.
10. H.Z. Fu, X. Long, Y.S. Ho, China's research in chemical engineering journals in science citation index expended: a bibliometric analysis, Scientometrics 98(1) (2014) 119-136.
11. J.M. Merigó, C. Cancino, F. Coronado, D. Urbano, Academic research in innovation: a country analysis, Scientometrics 108(2) (2016) 559-593.
12. V.K. Singh, A. Uddin, D. Pinto, I. Olmos, Computer science research: the top 100 institutions in India and in the World, Scientometrics 104(2) (2015) 529-553.
13. N.J. Van Eck, L. Waltman, Software survey: VOSviewer, a computer program for bibliometric mapping, Scientometrics 84(2) (2010) 523-538.
14. M.M. Kessler, Bibliographic coupling between scientific papers, Am. Doc., 14(1) (1963) 10-25.
15. H. Small, Co-citation in the scientific literature: A new measure of the relationship between two documents, J. Am. Soc. Inf. Sci. 24(4) (1973) 265-269.
16. R.N. Broadus, Towards a definition of "Bibliometrics", Scientometrics, 12(5-6) (1987) 373-379.
17. A. Pritchard, Statistical bibliography or bibliometrics? J. Documentation, 25 (1969) 348-349.
18. G.W. Schwert, The Journal of Financial Economics: a retrospective evaluation (1974-91), J. Financial Econ. 33(3) (1993) 369-424.
19. M.T. Garcia, M.L. Pereira-do-Carmo, M.V. Santos-Alvarez, 25 years of Technovation: characterisation and evolution of the journal, Technovation 26(12) (2006) 1303-1316.
20. F.J. Martínez-López, J.M. Merigó, L. Valenzuela, C. Nicolás, Fifty years of the European Journal of Marketing: A bibliometric analysis, Eur. J. Marketing, 52(1/2) (2018) 439-468.

21. P.M. Podsakoff, S.B. MacKenzie, N.P. Podsakoff, D.G. Bachrar, Scholarly influence in the field of management: A bibliometric analysis of the determinants of university and author impact in the management literature in the past quarter century, J. Manag. 34(4) (2008) 641-720.
22. J. E. Hirsch, An index to quantify an individual's scientific research output, Proc. Natl. Acad. Sci. U.S.A 102(46) (2005) 16599-16572.
23. F. Blanco-Mesa, J.M. Merigó, A.M., Gil-Lafuente, Fuzzy decision making: a bibliometric-based review, J. Intell. Fuzzy Syst. 32(3) (2017) 2033-2050.
24. L. Valenzuela, J.M. Merigó, W. Johnston, C. Nicolas, F. Jaramillo, Thirty years of the Journal of Business & Industrial Marketing: A bibliometric analysis, J. Bus. Ind. Mark. 32(1) (2017) 1-18.
25. D. Yu, A scientometrics review on aggregation operator research, Scientometrics 105(1) (2015) 115-133.
26. M.J. Cobo, A.G. Lopez-Herrera, E. Herrera-Viedma, F. Herrera, Science Mapping software tools; review, analysis and cooperative study among tools, J. Am. Soc. Inf. Sci. Technol. 62(7) (2011) 1382-1402.