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## **PROCEEDINGS**

### **Volume III**

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United States	13	14.77
Peru	9	10.23
Germany	8	9.09
Japan	8	9.09
Latvia	8	9.09
Brazil	5	5.68
Mexico	5	5.68
Ecuador	3	3.41
Egypt	3	3.41
Taiwan	3	3.41
Austria	2	2.27
Canada	2	2.27
Poland	2	2.27
Belgium	1	1.14
China	1	1.14
Colombia	1	1.14
Costa Rica	1	1.14
Croatia	1	1.14
Czech Republic	1	1.14
Iraq	1	1.14
Italy	1	1.14
Norway	1	1.14
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Paraguay	1	1.14
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Saudi Arabia	1	1.14
South Africa	1	1.14
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## Foreword

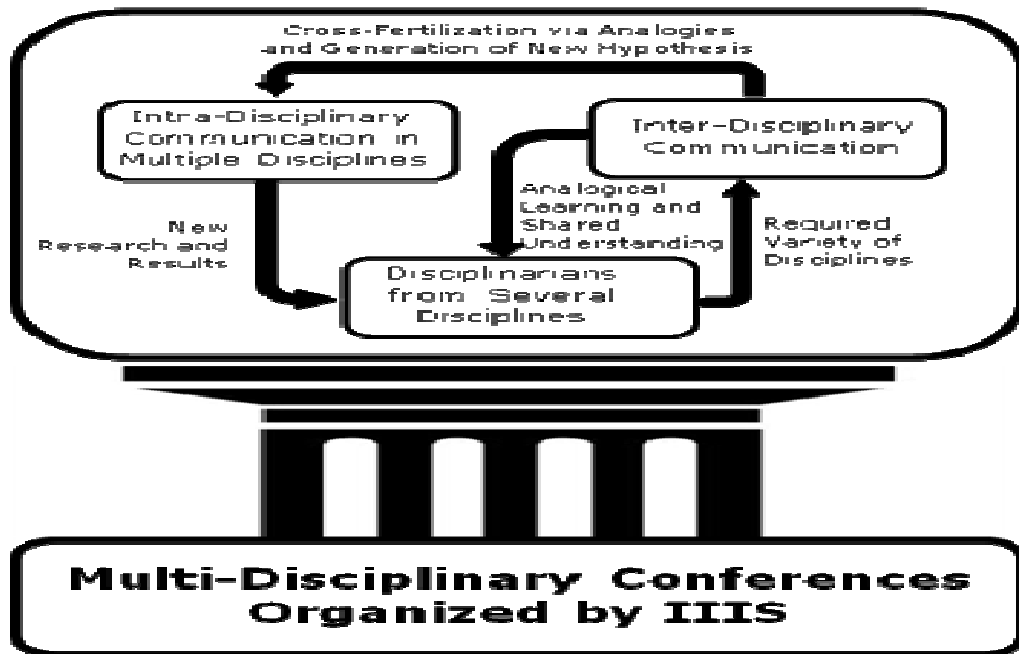
Our purpose in the 23<sup>rd</sup> World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI 2019) is to provide, in these increasingly related areas, a ***multi-disciplinary forum, to foster interdisciplinary communication*** among the participants, and to support the sharing process of diverse perspectives of the same trans-disciplinary concepts and principles.

Systemics, Cybernetics and Informatics (SCI) are increasingly being related to each other in almost every scientific discipline and human activity. Their common trans-disciplinarity characterizes and communicates them, generating strong relations among them and with other disciplines. They work together to create a whole new way of thinking and practice. This phenomenon persuaded the Organizing Committee to structure WMSCI 2019 as a multi-conference where participants may focus on one area, or on one discipline, while allowing them the possibility of attending conferences from other areas or disciplines. This systemic approach stimulates cross-fertilization among different disciplines, inspiring scholars, originating new hypothesis, supporting production of innovations and generating analogies; which is, after all, one of the very basic principles of the systems' movement and a fundamental aim in cybernetics.

WMSCI 2019 was organized and sponsored by the International Institute of Informatics and Systemics (IIIS, [www.iiis.org](http://www.iiis.org)), member of the International Federation of Systems Research (IFSR). The IIIS is a ***multi-disciplinary organization for inter-disciplinary communication and integration***, which includes about 5,000 members. Consequently, a main purpose of the IIIS is to foster knowledge integration processes, interdisciplinary communication, and integration of academic activities. Based on 1) the transdisciplinarity of the systemic approach, along with its essential characteristic of emphasizing *relationships* and *integrating* processes, and 2) the multi-disciplinary support of cybernetics' and informatics' concepts, notions, theories, technologies, and tools, the IIIS has been organizing multi-disciplinary conferences as a platform for fostering inter-disciplinary communication and knowledge integration processes.

Multi-disciplinary conferences are organized by the IIIS as support for ***both intra- and inter-disciplinary*** communication. Processes of intra-disciplinary communication are mainly achieved via traditional paper presentations in corresponding disciplines, while conversational sessions, regarding trans- and inter-disciplinary topics, are among the means used for inter-disciplinary communication. Intra- and inter-disciplinary communications might generate *co-regulative cybernetic loops*, via negative feedback, and *synergic* relationships, via positive feedback loops, in which both kinds of communications could increase their respective effectiveness. Figure 1 shows at least two cybernetic loops if intra- and inter-disciplinary are adequately related. A necessary condition for the effectiveness of Inter-disciplinary communication is an adequate level of **variety** regarding the participating disciplines. *Analogical thinking and learning processes* of disciplinarians depend on it; which in turn are potential sources of the creative tension required for cross-fertilization

among disciplines and the generations of new hypotheses. An extended presentation regarding this issue can be found at [www.iis.org/MainPurpose](http://www.iis.org/MainPurpose).



**Figure 1**

In the specific case of Systemics, Cybernetics and Informatics (SCI), the IIS is an organization dedicated to contribute to the development of the Systems Approach, Cybernetics, and Informatics potential, using both: knowledge and experience, thinking and action, theory and practice, for:

- a) The identification of synergistic relationships among Systemics, Cybernetics and Informatics, and between them and society.
- b) The promotion of contacts among the different academic areas, through the transdisciplinarity of the systems approach.
- c) The identification and implementation of communication channels among the different professions.
- d) The supply of communication links between the academic and professional worlds, as well as between them and the business world, both public and private, political and cultural.
- e) The stimulus for the creation of integrative arrangements at different levels of society, as well as at the family and personal levels.
- f) The promotion of trans-disciplinary research, both on theoretical issues and on applications to concrete problems.

These IIS objectives have oriented the organizational efforts of yearly WMSCI/ISAS/IMSCI/CISCI conferences since 1995.



On behalf of the Organizing Committee, I extend our heartfelt thanks to:

1. The 456 members of the different Program Committees, from 56 countries (including the PC members of the events organized in its context and jointly with WMSCI 2019). Almost all the members of the Program Committee are ***authors or co-authors sessions' best papers in previous conferences***, i.e. papers selected by the respective audience as the best paper of the session in which they were presented.
2. The 748 additional reviewers, from 83 countries, for their ***double-blind peer reviews***; and
3. The 232 reviewers, from 46 countries, for their efforts in making the ***non-blind peer reviews***. (Some reviewers supported both: non-blind and double-blind reviewing for different submissions).

The names and affiliation of both kinds of reviewers are listed in these proceedings. We extend our gratefulness to all of them. The scholarly quality of the authors and the reviewers is what define the quality of the conference and its respective proceedings. Consequently, our gratitude is to the members of the programs' committees, both kinds of reviewers and the collaborating authors.

A total of 1537 reviews made by 980 reviewers, from 86 countries, (who made at least one review) contributed to the quality achieved in WMSCI 2019. This means an average of 8.49 reviews per submission (181 submissions were received). ***Each registered author had access, via the conference web site, to the reviews that recommended the acceptance of their respective submissions.*** Each registered author could also get information about: 1) the average of the reviewers' evaluations according to 8 criteria, and the average of a global evaluation of his/her submission; and 2) the comments and the constructive feedback made by the reviewers, who recommended the acceptance of his/her submission, so the author would be able to improve the final version of the paper.

In the organizational process of WMSCI 2019, about 181 articles were submitted. These pre-conference proceedings include about 88 papers that were accepted for presentation from 30 countries (41 countries taking into account the presentations in collocated events). I extend our thanks to the invited sessions' organizers for collecting, reviewing, and selecting the papers that will be presented in their respective sessions. The submissions were reviewed as carefully as time permitted; it is expected that most of them will appear in a more polished and complete form in scientific journals. This information about WMSCI 2019 is summarized in the following table, along with the other collocated events:

Conference	# of submissions received	# of reviewers that made at least one review	# of reviews made	Average of reviews per reviewer	Average of reviews per submission	# of papers included in the proceedings	% of submissions included in the proceedings
WMSCI 2019	181	980	1537	1.57	8.49	88	48.62%
IMSCI 2019	88	439	974	2.22	11.07	41	46.59%
WMSCI & IMSCI	269	1419	2511	1.77	9.33	129	47.96%
CISCI 2019	118	572	1205	2.11	10.21	65	55.08%
<b>TOTAL</b>	<b>387</b>	<b>1991</b>	<b>3716</b>	<b>1.87</b>	<b>9.60</b>	<b>194</b>	<b>50.13%</b>

All submissions were peer reviewed by the two-tier reviewing methodology of the International Institute of Informatics and Systemics (IIIS, [www.iiis.org](http://www.iiis.org)). As it might be noticed, from the table above, **9.6 reviews were made, in average, for each submission we received**. After the conference is over, the names of the reviewers will be published on the IIIS web site along with the titles of the papers each reviewer reviewed. This means that what had been a double-blind review, up to the conference, is transformed to single-blind review, after the conference is over. In this way, each author would have information about the names of the reviewers of his/her submission, but not vice-versa. Likewise, each author would know how many reviewers reviewed his/her submission and relate it to the average, being informed in the above table, of 9.6 reviews per paper.

Our two-tier reviewing methodology meet two different objectives of peer-review: 1) to improve the paper via non-anonymous reviewers (non-blind reviews) and 2) to improve the acceptance/non-acceptance decision of the Organizing Committee via traditional anonymous reviewers (double-blind reviews) A recommendation to accept, made by non-anonymous reviews, is a **necessary** condition, but it is **not a sufficient** one. A submission, to be accepted, should also have a majority of its double-blind reviewers recommending its acceptance. These two necessary conditions generate a more reliable and rigorous reviewing than any of those reviewing methods, based on just one of the indicated methods, or just on the traditional double-blind reviewing.

We extend our gratitude to the invited sessions' organizers: Dr. Shigehiro Hashimoto and Dr. Natalja Lace; as well as to the special track co-chairs and the co-editors of these proceedings, for the hard work, energy and eagerness they displayed preparing their respective sessions. We express our intense gratitude to Professor William Lesso (1931-2015) for his wise and timely, adequate and valuable tutoring, for his eternal energy, integrity, and continuous support and advice, as the Program Committee Chair of past conferences (since 1981), as well as for being a very caring old friend and intellectual father to many of us. We also extend our gratitude to Professor Belkis Sánchez, who brilliantly managed the organizing process.

Our gratitude to Professors Bela H. Banathy, Stafford Beer, George Klir, Karl Pribram, Paul A. Jensen, and Gheorghe Benga who dignified our past WMSCI conferences by being their Honorary Presidents. We also extend our gratitude to the following scholars, researchers,

and professionals who accepted to deliver plenary workshops and/or to address the audience of the General Joint Plenary Sessions with keynote addresses.

We would like also to extend our gratefulness to Professor Shigehiro Hashimoto for his yearly support in the last 20 years as well as for his editorial work for the journal; as well as to Professor Grandon Gill, Dr. Jeremy Horne, Professor Thomas Marlowe and Professor Matthew E. Edwards for their continuous advice and support in the conferences they participated in, along the last 12 years; as well as in the conferences they were not able to participate in. Their advices and the kind of care they provided us with are highly valued and appreciated.

We also extend our gratitude to the following scholars, researchers, and professionals who accepted to deliver plenary workshops and/or to address the audience of the General Joint Plenary Sessions with keynote addresses.

### **Workshops and Conversational Sessions**

**Professor Thomas Marlowe**, Seton Hall University, USA, Department of Mathematics and Computer Science, Program Advisor for Computer Science, Doctor in Computer Science and, Doctor in Mathematics.

**Professor Stuart A. Umpleby**, The George Washington University, USA, President of the Executive Committee of the International Academy for Systems and Cybernetics Sciences, Former President of The American Society of Cybernetics.

**Professor Matthew E. Edwards**, Alabama A&M University. USA, Professor of Physics and, Former Dean, School of Arts and Sciences, Director of IHSEAR: Institute of Higher Science Education Advancement, and Research.

**Professor Tatiana Medvedeva**, Siberian State University of Transport. Russia, Department of World Economy and Law Former Head of the Scientific and Practical Center for Business and Management.

**Dr. Bruce E. Peoples**, Innovations LLC, USA, Founder and CEO, Formerly at Université Paris 8, France, Laboratoire Paragraphe, Chair Emeritus of an ISO/IEC Standards Committee, Generated over 50 Invention Disclosures, 15 Patent Applications and 11 Patent Awards.

**Professor William Swart**, East Carolina University, USA, FMR. Dean of Engineering and Technology at New Jersey Institute of Technology, Provost and Vice President for Academic Affairs at East Carolina University, Researcher and Consultant at NASA's Space Shuttle.

**Professor Richard Self**, University of Derby, UK, The School of Computing and Mathematics, Senior Lecturer in Analytics and Governance.

### **Plenary Keynote Speakers**

**Professor Thomas Marlowe**, Seton Hall University, USA, Department of Mathematics and Computer Science, Program Advisor for Computer Science, Doctor in Computer Science and, Doctor in Mathematics.

**Professor Shigehiro Hashimoto**, Kogakuin University, Japan, Councilor and Dean, Faculty of Engineering, Former Associate to the University President. Doctor of Engineering and Doctor of Medicine. Biomedical Engineering.

**Professor Matthew E. Edwards**, Alabama A&M University, USA. Professor of Physics and Former Dean of the School of Arts and Sciences. Director of IHSEAR: Institute of Higher Science Education, Advancement and Research.

**Dr. Paul Page**, Queen's University Belfast, UK, School of Electronics, Electrical Engineering & Computer Science, High Performance and Distributed Computing, Lecturer (Education) – Society & Community.

**Professor Stuart A. Umpleby**, The George Washington University, USA, President of the Executive Committee of the International Academy for Systems and Cybernetics Sciences, Former President of The American Society of Cybernetics.

**Professor Tatiana Medvedeva**, Siberian State University of Transport. Russia, Department of World Economy and Law Former Head of the Scientific and Practical Center for Business and Management.

**Fr. Dr. Joseph Laracy**, Seton Hall University, USA, College of Arts and Sciences, Department of Mathematics and Computer Science, Complex Systems, Differential Equations, and Dynamical Systems.

**Dr. Russell Jay Hendel**, Towson University, USA, Dept. of Mathematics. Researcher in Discrete Number Theory, the Theory of Pedagogy, Applications of Technology to Pedagogy, and the Interaction of Mathematics and the Arts.

**Dr. David Cutting**, Queen's University Belfast, UK, School of Electronics, Electrical Engineering and Computer Science, Course Director: BSc Software, Engineering with Digital Technology Partnership, Fellow of the Higher Education Academy.

**Professor William Swart**, East Carolina University, USA. FMR. Dean of Engineering and Technology at New Jersey Institute of Technology. Provost and Vice President for Academic Affairs at East Carolina University. Researcher and Consultant at NASA's Space Shuttle.

**Professor Christian Greiner**, Munich University of Applied Sciences, Germany, Associate Dean Applied Research, Professor at the Department of Business Administration.

**Dr. Robert Cherinka**, MITRE Corporation, USA, Chief Engineer, Software Engineering Technical Center at MITRE.

**Dr. Mario Lamanna**, Evoelectronics, Italy and Selex-SI, USA. Senior Scientist and Project Leader, Projects in the fields of Defense and Security.

**Mr. Joseph Prezzama**, MITRE Corporation, USA, Co-Department Head for the Joint Operations Southeast,. Tampa office of the MITRE Corporation, MS Software Engineering.

**Professor Oleg I. Redkin**, Saint Petersburg State University, Russia, Faculty of African and Asian Studies. Head of Arabic Studies.

**Dr. Bruce E. Peoples**, Innovations LLC, USA, Founder and CEO, Formerly at Université Paris 8, France, Laboratoire Paragraphe, Chair Emeritus of an ISO/IEC Standards Committee, Generated over 50 Invention Disclosures, 15 Patent Applications and 11 Patent Awards.

**Professor Olga Bernikova**, Saint Petersburg State University, Russia, Research Laboratory for Analysis and Modeling of Social Process. Member of the Editorial board of the journal “Islam in the Modern World”.

**Professor Margit Scholl**, Technical University of Wildau [FH], Germany, Faculty of Economics, Computer Science, Law, Business, and Administrative Informatics. Received a research prize from TH Wildau.

**Bruce Leybourne, MS**, Institute for Advance Studies on Climate Change (IASCC), USA, Research Director and Principal Investigator, MS in Geology from University of Southern Mississippi, USA, Former Navy tenure at the U.S. Naval Oceanographic Office, NASA's Stennis Space Center.

**Dr. Pawel Poszytek**, Foundation for the Development of the Education System, Poland. General Director, Member of working groups of the European Commission and the Ministry of National Education of Poland.

**Professor Richard Self**, University of Derby, UK, The School of Computing and Mathematics, Senior Lecturer in Analytics and Governance.

**Dr. Yaping Gao**, Quality Matters, USA, Senior Academic Director, 25 years experience in higher education both in China and in USA as faculty and online education manager and administrator.

**Dr. Tilia Stingl De Vasconcelos**, Business Consultant, Austria, Member of the European, Society for Education and Communication, Previously, University of Applied Sciences Austria, Information Management and Cross Cultural Communication.

**Professor Mohammad Ilyas**, Florida Atlantic University, USA, Department of Computer and Electrical Engineering and Computer Science, Former Dean of the College of Engineering and Computer Science; Member of Global Engineering Deans Council.

**Mg. Philipp Belcredi**, Comparative-Systemic Intervention, Austria, Owner and CEO, Former CEO of Pewag Chain. Inc.

**Professor Wen-Chen Hu**, University of North Dakota, USA, School of Electrical Engineering & Computer Science, Former (2010-2017) editor-in-chief of the International Journal of Handheld Computing Research (IJHCR).

**Professor Thomas Peisl**, Munich University of Applied Sciences. Germany, Professor of International Management and Strategy, Former Marketing Director at General Electric Europe.

**Professor Maritza Placencia Medina**, Departamento Académico de Ciencias Dinámicas de la Universidad Nacional Mayor de San Marcos, Peru, Facultad de Medicina, Centro de Investigaciones Tecnológicas.

**Professor Andrés Tremante**, Florida International University, USA, Department of Mechanical and Materials Engineering.

#### **Invited Sessions Organizers**

**Professor Shigehiro Hashimoto**, Kogakuin University, Japan. Councilor and Dean, Faculty of Engineering, Former Associate to the University President. Doctor of Engineering and Doctor of Medicine. Biomedical Engineering.

**Professor Dr. oec Natalja Lace**, Riga Technical University, Faculty of Engineering, Economy and Management. Head of Department of Corporate Finance and Economics.

Many thanks to Drs. Sushil Archarya, Esther Zaretsky, and to professors Michael Savoie, Hsing-Wei Chu, Mohammad Siddique, Friedrich Welsch, Thierry Lefevre, José Vicente Carrasquero, Angel Oropeza, and José Ferrer, for chairing and supporting the organization of conferences and/or special events or tracks in the context of, or collocated with, WMSCI 2019, and previous conferences. We also wish to thank all the authors for the quality of their papers, the Program Committee members and the additional reviewers for their time and their contributions in the respective reviewing processes.

Our gratefulness is also extended to the organizations that provided scientific, academic, professional, or corporate co-sponsorships in this conference and/of previous ones. The following are among these organizations:



Special Thanks to Dr. Jeremy Horne, Dr. Harvey Hyman, and Ms. Molly Youngblood Geiger (Google Partners Community Ambassador) for their efforts in helping us with the identification of above shown co-sponsors.

We extend our gratitude as well to professor Belkis Sanchez, Eng/Mg María Sánchez, Ms. Kilian Mendez, Mr. Jhonny Romero, Mr. Jaime Noguera, and Mr. Freddy Callaos for their knowledgeable effort in supporting the organizational process, maintaining the email lists, producing the hard copy and CD versions of the proceedings, developing and maintaining the software that supports the interactions of the authors with the reviewing process and the Organizing Committee, as well as for their support in the help desk, the promotional process, and their advising role in the promotion of the conference.

Professor Nagib C. Callaos, Ph. D.  
*WMSCI 2019 General Chair*  
[www.iiis.org/Nagib-Callaos](http://www.iiis.org/Nagib-Callaos)

**WMSCI 2019**  
**The 23<sup>rd</sup> World Multi-Conference on Systemics, Cybernetics and Informatics**

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