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## **PROCEEDINGS**

### **Volume I**

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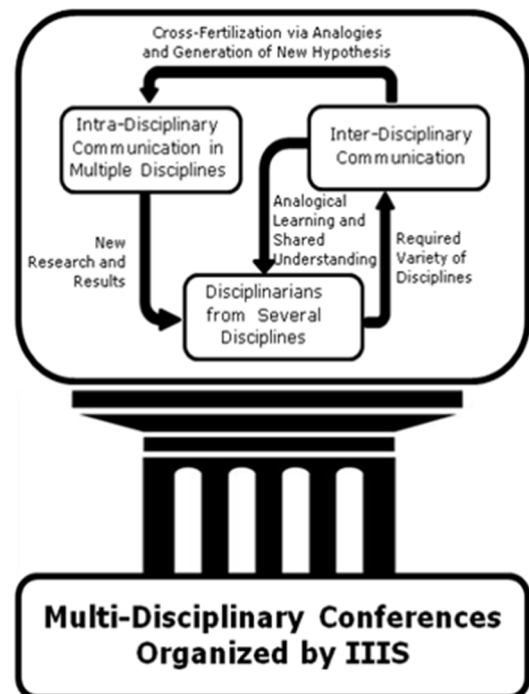
## FOREWORD

Our purpose in the 24<sup>th</sup> World Multi-Conference on Systemics, Cybernetics and Informatics (WMSCI 2020) 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 transdisciplinary concepts and principles.

Systemics, Cybernetics and Informatics (SCI) are being increasingly related to each other in almost every scientific discipline and human activity. Their common transdisciplinarity 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 2020 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 2020 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 5000 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 (at the right side) 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 <http://www.iiis.org/MainPurpose/>

In the specific case of Systemics, Cybernetics and Informatics (SCI), the IIIS 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 trans-disciplinarity 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 IIIS 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 406 members of the Program Committee from 50 countries (including the PC members of the events organized in its context and jointly with WMSCI 2020). Almost all the members of the Program Committee were ***authors or co-authors sessions' best papers***, i.e. papers selected by the respective audience as the best paper of the session in which they were presented;
2. The 478 additional reviewers, from 71 countries, for their ***double-blind peer reviews***; and
3. The 180 reviewers, from 49 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 1042 reviews made by 658 reviewers from 71 countries (who made at least one review) contributed to the quality achieved in WMSCI 2020. This means an average of 5.40 reviews per submission (193 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 2020, about 193 articles were submitted. These proceedings include about 78 papers that were accepted for presentation from 18 countries (33 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 2020 is summarized in the following table, along with the other collocated events:

This information about WMSCI 2020 is summarized in the following table, along with the other collocated conferences:

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
<b>WMSCI 2020</b>	193	658	1042	1.58	5.40	78	40.41 %
<b>IMSCI 2020</b>	97	302	639	2.12	6.59	42	43.30 %
<b>WMSCI/IMSCI 2020</b>	<b>290</b>	<b>960</b>	<b>1681</b>	<b>1.75</b>	<b>5.80</b>	<b>120</b>	<b>41.38 %</b>
<b>CISCI 2020</b>	102	455	943	2.07	9.25	48	47.06 %
<b>TOTAL 2020</b>	<b>392</b>	<b>1415</b>	<b>2624</b>	<b>1.85</b>	<b>6.69</b>	<b>168</b>	<b>42.86 %</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, 5.40 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 5.40 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, Dr. Elina Gaile-Sarkane, Dr. Lorayne Robertson, Dr. Renata Baracho, Dr. Inga Lapina, Dr. William Muirhead, and Dr. Marcelo Porto; 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 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 generously accepted to deliver keynote addresses or to organize invited sessions.

**Plenary Keynote Speakers** *(ordered by their presentations succession)*

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

**Professor Thomas Marlowe, USA**, Seton Hall University, Professor Emeritus, Department of Mathematics and Computer Science, PhD in Computer Science and PhD in Mathematics.

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

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

**Dr. William Muirhead, Canada**, University of Ontario, Institute of Technology, founding researcher of the EILAB in the UOIT Faculty of Education. Former Associate Provost, founding academic administrator of the university.

**Dr. Lorayne Robertson, Canada**, University of Ontario, Institute of Technology (UOIT), Former Assistant Dean in the Faculty of Education, Former Director of the Graduate Programs in Education.

**Dr. Peter Holowka, Canada,** Werklund School of Educational Technology at the University of Calgary, West Point Grey Academy in Vancouver, British Columbia.

**Dr. Steven Ehrlick, Canada,** Ryerson University, School of Media, Department of Radio and Television Arts, Associate Professor & Director, The Music Den.

**Professor T. Grandon Gill, USA,** University of South Florida, College of Business, Director of the Doctorate in Business Administration, Editor-in-Chief of Informing Science, Editor of the Journal of IT Education.

**Fr. Dr. Joseph R. Laracy, USA,** Seton Hall University, Department of Systematic Theology & Department of Mathematics and Computer Science.

**Professor Richard Segall, USA,** Arkansas State University, Department of Computer and Information Technology, Neil Griffin College of Business.

**Dr. Luigi Serra, Italy,** Cagliari, National Research Council of Italy, Institute of History of Mediterranean Europe, Technical Collaborator of Research Institutes and CTO at CNR ISEM (Istituto di Storia dell'Europa Mediterranea).

**Professor Sukjin Kang, South Korea,** Korea Aerospace University, Faculty of Business School. Head of College of Liberal Studies. Director of Interdisciplinary Studies in KAU, Director of Korean Society for Teaching English Literature, Director of The English Language and Literature Association of Korea.

**Professor Mark M. Budnik, USA,** Valparaiso University. Electrical and Computer Engineering, Paul H. Brandt Professor in Engineering, Houghton College. Electrical Engineering, Irwin Chair of Engineering.

**Dr. Mario LaManna, Italy/USA,** Evoelectronics (Italy), and Selex-SI (USA), Senior Scientist and Project Leader, Projects in the fields of defense and security.

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

**Dr. Russell Jay Hendel, USA,** Towson University, Dept. of Mathematics, doctoral program at the Spertus Institute for a degree in Jewish studies.

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

**Dr. Madhumita Banerjee, USA,** University of Wisconsin-Parkside, Sociology Department. Assistant Professor and Director, Sociology Online Degree Completion Program.

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

**Mg. Philip Belcredi, Austria,** CEO (OMV, Compass Group, Pewag), Comparative-Systemic Intervention.

**Keynote Speakers** (*Alphabetical Order*)

**Dr. Kevin Foltz, USA,** Institute for Defense Analyses, Information Technology and Systems Division, Independent Technical Analyst for the Department of Defense.

**Professor Elina Gaile-Sarkane, Latvia,** Riga Technical University, Dean of the Faculty of Engineering Economics and Management (FEEM).

**Dr. Tina Haase, Germany,** Aunhofer Institute for Factory Operation and Automation IFF, Magdeburg.

**Dr. Maria Jakubik, Finland,** Haaga-Helia University of Applied Sciences, Hanken School of Economics, Head of Master's Degree, Programme in International Business Management (IBMA).

**Professor Natalja Lace, Latvia,** Riga Technical University, Head of Department of Corporate Finance and Economics, Faculty of Engineering Economics and Management (FEEM).

**Dr. Songmei Yu, USA,** Felician University, Department of Computer Science, Institute for Information Science.

**Invited Sessions Organizers** (*Alphabetical Order*)

**Professor Renata Baracho, Brazil,** Federal University of Minas Gerais, President of the National of Research and post-graduate Studies in Information Sciences (Associação Nacional de Pesquisa e Pós-Graduação em Ciência DA Informação – ANCIB).

**Professor Elina Gaile-Sarkane, Latvia,** Riga Technical University, Dean of the Faculty of Engineering Economics and Management (FEEM).

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

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**Dr. William Muirhead, Canada,** University of Ontario, Institute of Technology, founding researcher of the EILAB in the UOIT Faculty of Education. Former Associate Provost, founding academic administrator of the university.



**Professor Marcelo Porto, Brazil,** Federal University of Minas Gerais, Department of Transportation Engineering and Geotechnics.

**Dr. Lorayne Robertson, Canada,** University of Ontario, Institute of Technology (UOIT), Former Assistant Dean in the Faculty of Education, Former Director of the Graduate Programs in Education.

Many thanks to the members of the Organizing Committee and to those who chaired special tracks. We would also like to express our special gratefulness to Professor Thomas Marlowe. Professor T. Grandon Gill, Dr. Jeremy Horne, Professor Sukjin Kang, Professor Shigehiro Hashimoto, Dr. Russell Jay Hendel, Professor Michael Savoie, Professor Hsing-Wei Chu, etc. for their generosity in providing support with their advices and for answering our inquiries, as well as for their spontaneous and timely alerts. Thank you so very much.

Our gratefulness is also extended to the organizations that provided scientific, academic, professional, or corporate co-sponsorships in this conference and/or 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.

There is no way to express the huge gratitude we have to Professor Belkis Sanchez for the great job she did as President of the Organizing Committee; analyst, designer, and manager of the implementation of the information systems required for this virtual conference; chair of the printed and electronic proceedings; and general director of the Conference Secretariat.

Professor Nagib C. Callaos, Ph.D.  
WMSCI 2020 General Chair  
[www.iiis.org/Nagib-Callaos](http://www.iiis.org/Nagib-Callaos)



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