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ELECTRONICS & COMMUNICATIONS

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Preface

This book contains proceedings of the 7th WSEAS International Conference on ELECTRONICS, HARDWARE, WIRELESS and OPTICAL COMMUNICATIONS (EHAC '08) which was held in University of Cambridge, Cambridge, UK, February 20-22, 2008. The first EHAC conference was held in Cadiz, Spain in 2002. The World Conference of WSEAS on ELECTRONICS, HARDWARE, WIRELESS and OPTICAL COMMUNICATIONS is the internationally recognized Forum for the dissemination of the latest advances on Electronics and Hardware Engineering, Wireless, Optical, Mobile and Satellite Communications etc as well as their impact and their interaction with other areas of Electrical Engineering and Applied Physics. The various WSEAS conferences on Electronics, Hardware Engineering, Wireless and Optical Communications have produced more than 150 volumes of Proceedings while the best papers and the invited papers after extension and after peer review from 4 international referees, are published in WSEAS Journals covered by all the major scientific indexes.

The 7th WSEAS International Conference on ELECTRONICS, HARDWARE, WIRELESS and OPTICAL COMMUNICATIONS (EHAC'08) aims to disseminate the latest research and applications in the aforementioned fields. The range of topics covered is listed on the Call for Papers. The friendliness and openness of the WSEAS conferences, adds to their ability to grow by constantly attracting young researchers.

The meetings have always had a special appeal to young researchers and are characterized by a friendly atmosphere in which delegates at different stages of their careers can talk to each other. Scientists within all the areas of Information Technologies will benefit from attending the meeting. As a conclusion, the conference offers to the engineers and scientists a unique forum for establishing new collaborations within present or upcoming research projects, exchanging useful ideas, presenting recent research results, participating in discussions and establishing new academic collaborations, linking university with the industry.

Expanded and enhanced versions of papers published in these conference proceedings are also going to be considered for possible publication in one of the WSEAS journals that participate in the major International Scientific Indices (Elsevier, Scopus, EI, Compendex, INSPEC, CSA .... see: www.worldses.org/indexes) these papers must be of high-quality (break-through work) and a new round of a very strict review will follow. (No additional fee will be required for the publication of the extended version in a journal).

We cordially thank all the people of WSEAS for their efforts to maintain the high scientific level of conferences, proceedings and journals.

The Editors

Table of Contents

Plenary Lecture 1: Toward Human-Level Machine Intelligence 11
Lofti A. Zadeh

Plenary Lecture 2: Decision support systems, human centric/centered computing, and computing with words: a synergistic combination? 13
Janusz Kacprzyk

Plenary Lecture 3: Clustering with an N-Dimensional Extension of Gielis Superformula 14
Angel Kuri-Morales

Plenary Lecture 4: Data Mining through Data Visualisation: Computational Intelligence Approaches 15
Colin Fyfe

Plenary Lecture 5: Formalisation and Verification in a Type-theoretic Framework 16
Zhaohui Luo

Part 1: Electronics

VLSI: An Investigation into the Effect of Non-Uniform Distribution of Current on Crosstalk Noise 19
H. J. Kadim

Verification of Delay Insensitivity in Bit-Level Pipelined Dual-Rail Threshold Logic Adders 23
A. Neslin Ismailoglu, Murat Askar

About of Nonlinear Digital Control for a DC-to-DC Power Converter 28
Jenica Ileana Corcau, Eleonor Stoenescu

An Improved CMOS Error Amplifier Design for LDO Regulators in Communication Applications 31
Xinquan Lai, Donglai Xu

Robust Watermarking of Audio with Blind Self-Authentication 35
O. Farooq, S. Datta, J. Blackledge

Electrical properties of room temperature sputtered Y2O3 and MOSFET characteristics 40
Young-Je Cho, Ji-Hoon Shin, Jae-Kyu Lee, Young-Bae Kim, Duck-Kyun Choi

New-Fangled Fingerprint Engendered Key For A Secured Voip 45
P. Aruland, A. Shanmugam

CAD dependent Estimation of Optimal k-Value in FSM onto k-LUT FPGA mappings, based on standard benchmark networks 49
Stavros Dokouzyannis, Efsevios Arzoumanidis

Intelligent Relaying to Reduce Power Consumption in Mobile Telephony 54
Narasimha Raghavan, Fasil Latheef, R Dhivya

2-inch polycrystalline silicon thin film transistor array using field aided lateral crystallization 60
Jae Hoon Jung, Myeong Ho Kim, Young Bae Kim, Duck-Kyun Choi

Dimensioning of Power semiconductor devices in their unnatural environment 65
Dinesh Chamund, Noel Y. A. Shammas

Part 2: Hardware Engineering

Transforming Dependence Graphs into Signal Flow Graphs During Systolic Array Processors 73

Design
Argiris Mokios, Stavros Dokouzyannis

A New EDA Defined Interchange Format for Processing of Dependence Graphs 79
Stavros Dokouzyannis, Argiris Mokios

A Comparison of Discrete Cosine and Discrete Wavelet Transforms for Efficient Low-Power Oriented Embedded Design 85
Stavros Dokouzyannis, Asterios Kechagias

Comparative -Experimental Study of FSM Optimization and Mapping onto LUT- FPGAs, Using SIS, MVSIS and ABC Packages 91
Stavros Dokouzyannis, Efsevios Arzoumanidis

Efficient Design Method of ROM 97
Ki-Sang Jung, Yong-Eun Kim, Seong-Ik Cho, Jin-Gyun Chung

Reconfigurable Mobile Robot Controller 101
Shashank S. Shriramwar

Design and Analysis of WiMAX's Security System on FPGA 107
Reza Ebrahimi Atani, Mehdi Baboli, Sattar Mirzakuchaki

Part 3: Optical Communications

A 3.2Gb/s Clock and Data Recovery Circuit Without Reference Clock for a High-Speed Serial Data Link 113
Kang Jik Kim, Ki Sang Jeong, Seong Ik Cho

Without a Reference Clock Wide Tuning Range Clock and Data Recovery Circuit 118
Si-Young Choi, Hang-Geun Jeong

Next Generation Ethernet Access Networks: GPON vs. EPON 122
T. Orphanoudakis, H.-C. Leligou, J. D. Angelopoulos

Part 4: Wireless Communications

Statistic Characteristics of M-ary FSK Signal in the Presence of Gaussian Noise, Intersymbol Interference and Rayleigh Fading 129
Mihajlo Stefanovic, Dragana Krstic, Natasa Kapacinovic, Srdjan Jovkovic

Improvements BER with Convolutional Codes and Multilevel Coded Modulation 133
Marius-Cristian Niculescu, Elena Niculescu

Design and Analysis of a One-Step Addressing Protocol for Ad Hoc Networks 140
Hamed Nassar, Hassan Al-Mahdi, Magdi El-Gabali, Safa Abdul Aziz

Simulation and Comparison of Communication Protocols in Ad Hoc Network 146
Gaurav Sethi, Manoj Kumar

A Tunable SC 2^{nd} Order Bandpass Σ-Δ Modulator with Novel Architecture 157
Jae-Bung Kim, Seong-Ik Cho

Simulation environment for performance evaluation of SIP handover 162
Rok Libnik, Ales Svigelj, Gorazd Kandus

Signalling Extensions for QoS Support in a IEEE 802.16d/e Domain 168
Fausto Andreotti, Nicola Ciulli, Marilia Curado, Giada Landi, Cristina Nardini

Security policy for deducting unauthorized IP based mobile host inside the network 177
V. K. Sanjeevi, Veluchandhar, S. Sakthivel, M. Supriya

Implementation of Wireless VoIP System based on VPN 182
Dae-Hyun Ryu, Seung-Hoon Nam

Converting an Existing Communication System into SCA compliant SDR 187
Usman Shahid Khan, Shoab Ahmed Khan

A Novel Design Method of Time-Interleaved Subranging ADC 192
Ki Chul Park, Seong Ik Cho

Improved IPv6 Mobility Architecture in IPv4 Networks 196
J. Gnana Jayanthi, S. Albert Rabara, N. Rajendran

A Review of Uniqueness and Variations in Throughput due to Performance Parameters of Simulators on Manet Routing Protocols 202
M. Sulleman Memon, Manzoor Hashmani, Niaz A. Memon

Diversity Techniques to combat fading in WiMAX 209
Abderrahmane Anou, Mustapha Djebari, Merouane Mehdi, Messaoud Bensebti

Simulation of the Impact of Pilot Signals on OFDMA Systems 214
M. Haridim, M. Bank

A New Constructive Approximation in Log-Map Turbo Decoder 220
Shahab Asoodeh

VOIP on Wireless LAN: A Comprehensive Review 225
Sana Munir, Imran Ahmad

Performance Analysis of Antipodal modulated Direct Sequence Ultra-Wide Bandwidth 231
Shahab Asoodeh

Facilitating Method on LDPC Codes 235
Shahab Asoodeh

Wireless C45 Based Vital-Signs Monitoring System for Patient after Heart Operation Care 239
S. Noimanee, T. Tunkasiri, K. Siriwitayakorn, J. Tuntrakoon

Practical Issues in the Combining of MIMO Techniques and RoF in OFDM/A Systems 244
Ilkka Harjula, Antonio Ramirez, Francisca Martinez, David Zorrilla, Marcos Katz, Valentin Polo

Quality of Service in Wireless LAN 249
Fozia Hameed, Imran Ahmad

New Approach in LDPC Codes 253
Ali. A. Dargahi, Shahab Asoodeh

Authors Index 257

Plenary Lecture 1

Toward Human-Level Machine Intelligence

Professor Lotfi A. Zadeh
Professor in the Graduate School, Computer Science Division
Department of Electrical Engineering and Computer Sciences
University of California
Berkeley, CA 94720 -1776
Director, Berkeley Initiative in Soft Computing (BISC)

Abstract: Achievement of human-level machine intelligence has profound implications for modern society—a society which is becoming increasingly infocentric in its quest for efficiency, convenience and enhancement of quality of life.

Humans have many remarkable capabilities. Among them a capability that stands out in importance is the human ability to perform a wide variety of physical and mental tasks without any measurements and any computations, based on perceptions of distance, speed, direction, intent, likelihood and other attributes of physical and mental objects. A familiar example is driving a car in city traffic. Mechanization of this ability is a challenging objective of machine intelligence.

Science deals not with reality but with models of reality. In large measure, models of reality in scientific theories are based on classical, Aristotelian, bivalent logic. The brilliant successes of science are visible to all. But when we take a closer look, what we see is that alongside the brilliant successes there are areas where achievement of human-level machine intelligence is still a distant objective. We cannot write programs that can summarize a book. We cannot automate driving a car in heavy city traffic. And we are far from being able to construct systems which can understand natural language.

Why is the achievement of human-level machine intelligence a distant objective? What is widely unrecognized is that one of the principal reasons is the fundamental conflict between the precision of bivalent logic and imprecision of the real world.

In the world of bivalent logic, every proposition is either true or false, with no shades of truth allowed. In the real world, as perceived by humans, most propositions are true to a degree. Humans have a remarkable capability to reason and make rational decisions in an environment of imprecision, uncertainty, incompleteness of information and partiality of truth. It is this capability that is beyond the reach of bivalent logic—a logic which is intolerant of imprecision and partial truth.

A much better fit to the real world is fuzzy logic. In fuzzy logic, everything is or is allowed to be graduated, that is, be a matter of degree or, equivalently, fuzzy. Furthermore, in fuzzy logic everything is or is allowed to be granulated, with a granule being a clump of elements drawn together by indistinguishability, similarity, proximity or functionality. Graduation and granulation play key roles in the ways in which humans deal with complexity and imprecision. In this connection, it should be noted that, in large measure, fuzzy logic is inspired by the ways in which humans deal with complexity, imprecision and partiality of truth. It is in this sense that fuzzy logic is human-centric.

In coming years, fuzzy logic and fuzzy-logic-based methods are likely to play increasingly important roles in achievement of human-level machine intelligence. In addition, soft computing is certain to grow in visibility and importance. Basically, soft computing is a coalition of methodologies which in one way or another are directed at the development of better models of reality, human reasoning, risk assessment and decision making. This is the primary motivation for soft computing—a coalition of fuzzy logic, neurocomputing, evolutionary computing, probabilistic computing and machine learning. The guiding principle of soft computing is that, in general, better results can be achieved through the use of constituent methodologies of soft computing in combination rather than in a stand-alone mode.

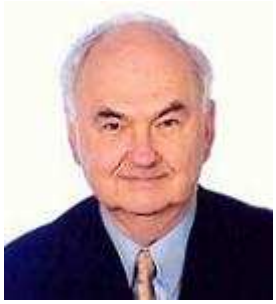
Brief Biography of the Speaker: LOTFI A. ZADEH is a Professor in the Graduate School, Computer Science Division, Department of EECS, University of California, Berkeley. In addition, he is serving as the Director of BISC (Berkeley Initiative in Soft Computing).

Lotfi Zadeh is an alumnus of the University of Tehran, MIT and Columbia University. He held visiting appointments at the Institute for Advanced Study, Princeton, NJ; MIT, Cambridge, MA; IBM Research Laboratory, San Jose, CA; AI Center, SRI International, Menlo Park, CA; and the Center for the Study of Language and Information, Stanford University. His earlier work was concerned in the main with systems analysis, decision analysis and information systems. His current research is focused on fuzzy logic, computing with words and soft computing, which is a coalition of fuzzy logic, neurocomputing, evolutionary computing, probabilistic computing and parts of machine learning.

Lotfi Zadeh is a Fellow of the IEEE, AAAS, ACM, AAAI, and IFSA. He is a member of the National Academy of Engineering and a Foreign Member of the Russian Academy of Natural Sciences, the Finnish Academy of Sciences, the Polish Academy of Sciences, Korean Academy of Science & Technology and the Bulgarian Academy of Sciences. He is a recipient of the IEEE Education Medal, the IEEE Richard W. Hamming Medal, the IEEE Medal of Honor, the ASME Rufus Oldenburger Medal, the B. Bolzano Medal of the Czech Academy of Sciences, the Kampe de Feriet Medal, the AACC Richard E. Bellman Control Heritage Award, the Grigore Moisil Prize, the Honda Prize, the Okawa Prize, the AIM Information Science Award, the IEEE-SMC J. P. Wohl Career Achievement Award, the SOFT Scientific Contribution Memorial Award of the Japan Society for Fuzzy Theory, the IEEE Millennium Medal, the ACM 2001 Allen Newell Award, the Norbert Wiener Award of the IEEE Systems, Man and Cybernetics Society, Civitate Honoris Causa by Budapest Tech (BT) Polytechnical Institution, Budapest, Hungary, the V. Kaufmann Prize, International Association for Fuzzy-Set Management and Economy (SIGEF), the Nicolaus Copernicus Medal of the Polish Academy of Sciences, the J. Keith Brimacombe IPMM Award, the Silicon Valley Engineering Hall of Fame, the Heinz Nixdorf MuseumsForum Wall of Fame, other awards and twenty-six honorary doctorates. He has published extensively on a wide variety of subjects relating to the conception, design and analysis of information/intelligent systems, and is serving on the editorial boards of over sixty journals.

Plenary Lecture 2

Decision support systems, human centric/centered computing, and computing with words: a synergistic combination?



Professor Janusz Kacprzyk
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Systems Research Institite
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Ul. Newelska 6, 01-447 Warsaw, Poland

Abstract: We start with a brief account of complex decision making problems, and advocate the use of modern approaches to real world decision making emphasizing the concept of a decision making process that involves more factors and aspects like: the use of explicit and tacit knowledge, intuition, individual habitual domains, non-trivial rationality, different paradigms, etc. We stress the need for computer based decision support systems that should exhibit some "intelligence" which is meant in an individual and collective perspective, and give an overview of main types of decision support systems.
We present some new so-called computing paradigms that try to attain a synergy, and bridge the gap between the human user and computer systems that is mainly caused by the fact that natural language is the only fully natural means of communication and articulation for a human being but it is "strange" to the computer. We advocate the so-called: human centric computing, human centered computing, human computing, etc. that can help bridge this gap.
Then, we present Zadeh's paradigm of computing with words (and perceptions) as a tool that may help bring computing closer to the human being by an explicit use of (quasi)natural language in many phases of computing, problem solving, etc.
We indicate relations between the computing with words and human centric computing paradigms, and indicate – first – that the former can be viewed as an attempt at providing proper tools to implement the latter, and that both can play a crucial role in intelligent decision support systems.
We show some implementations of using linguistic data summaries in a business context and show that they can be viewed as extremely human consistent data mining tools, notably for novice users.

Brief biography of the speaker: Janusz Kacprzyk is Professor of Computer Science at the Systems Research Institute, Polish Academy of Sciences, and Honorary Professor at the Department of Mathematics, Yli Normal University, Shanxi, China. He has been a visiting professor at many universities in the USA, England, Italy and Mexico. He is Academician (Member of the Polish Academy of Sciences).
His research interests include intelligent systems, soft computing, fuzzy logic, decision making, decision analysis and decision support, database querying, information retrieval, data analysis, data mining, etc.
He is President of IFSA (International Fuzzy Systems Association), and President of the Polish Society for Operational and Systems Research.
He is Fellow of IEEE and IFSA. He received The 2005 IEEE CIS Fuzzy Pioneer Award for pioneering works on multistage fuzzy control, notably fuzzy dynamic programming, and The Sixth Kaufmann Prize and Gold Medal for pioneering works on the use of fuzzy logic in economy and management.
His publication record is: 5 books, 30 volumes, 300 papers. He is Editor in chief of 3 Springer's book series, and a co-editor of one Springer book series, is on the editorial boards of ca. 30 journals, and was a member of the IPC at more than 200 conferences.

Plenary Lecture 3

Clustering with an N-Dimensional Extension of Gielis Superformula

Professor Angel Kuri-Morales
Instituto Tecnologico Autonomo de Mexico
Mexico

Abstract: One of the most important issues regarding the analysis of raw data is the adequate identification of groups within such data. There have been many attempts to define a measure of what is "adequate" clustering. In all published cases, however, the adequateness of a cluster depends on a measure of distance chosen a priori. A metric or distance function is a function which defines a distance between elements of a set (for instance, one of the Ln family or Mahalanobis' distances have been utilized). Once a metric has been defined it remains to prove that the resulting clusters do, indeed, correspond to a proper classification. An obvious disadvantage of this methodology is, however, that in the space of the metric all clusters are hyperspherical. The shortcoming is that this fact immediately invalidates the attempt to find irregular shapes in such N-dimensional space. A metric induces a topology on a set but not all topologies can be generated by a metric. Topological unmetrisable spaces correspond, in this case, to a family of formulas developed originally by Gielis which he called a "superformula" (S). By replacing a metric by the elements of the hull defined by S we allow the search for more general shapes for our clusters. We report on the application of Vasconcelos Genetic Algorithm to find the parameters of S whose hulls encompass a large number of observations and the application of this method to data mining.

Brief biography of the speaker: Angel Fernando Kuri-Morales is an Engineer in Electronics by the Universidad Anahuac in Mexico City. He got a M.Sc. degree from the University of Illinois and a Ph.D. from Kennedy-Western University. He is the author of two text books and more than 70 articles published in international magazines and conferences. He is a member of the National System of Researchers (SNI). He won an international prize for the best solution to the "Iterated Prisoner's Dilemma" during the International Congress on Evolutionary Computation in 2000. He has been included in "Who is Who in the World" in 1988, 1998, 2000, 2002, 2003 and 2007. He received the best paper award during the 7th Industrial Conference in Data Mining, Leipzig, Germany. He has been president of several International Congresses, and invited speaker in many national and international scientific events. He belongs to the Evaluating Committee in the Area of Computer Science of CONACYT (the National Council for Science and Technology in Mexico). He was founder partner of Micromex, Inc. and IDET, Inc. and Director of Applied Research in the Center for Research in Computation of the National Polytechnic Institute. He is a Distinguished Lecturer of the Association for Computing Machinery (ACM) and member of the Scientific Committee of the World Scientific and Engineering Academy and Society (WSEAS). Currently he is the member of the Board of IBERAMIA, President of the Mexican Society for Artificial Intelligence and Professor in the Autonomous Technological Institute of Mexico (ITAM).

Plenary Lecture 4

Data Mining through Data Visualisation: Computational Intelligence Approaches

Professor Colin Fyfe
University of the West of Scotland
UK

Abstract: One of the major tasks today is to create information from data. We do not mean to define information in terms of Shannon or indeed any other mathematical definition but information in terms of the subjective experience of a viewer of the data. People (and probably animals) are very good at pattern recognition; we are far more robust pattern matchers than any current computer programs. Increasingly however, we are dealing with high dimensional (and often high volume) data so to gain intuitions about a data set, we often project data onto low dimensional manifolds. One question which arises then, is what projections to low dimensional manifolds are best in order to present the projected data to a human user. We illustrate several projections which have been found by artificial neural network extensions of Hebbian learning.

We then show examples of similar projections found by reinforcement learning; our rationale in this case is that we have agents interacting proactively with a database examining different projections and, without human intervention, getting rewards when the projections reveal some interesting structure. We then give examples of the same projections found by other computational intelligence methods such as the cross entropy method and artificial immune systems.

We then examine projections to nonlinear manifolds and show that with a particular model of an underlying latent space, we may identify clusters in data sets when such clusters are not visible in any low dimensional linear projection.

Finally we review different data representation techniques: we begin with parallel coordinates and point out some difficulties with this method before reviewing Andrews' Curves, a method from the 1970s which has only become truly practicable with the advent of modern desktop computers. An extension to this method came from Wegman and his colleagues in the 1990s. We also discuss a more recent extension and illustrate three dimensional projections of data samples dancing together.

Brief biography of the Speaker: Colin Fyfe completed his PhD in 1995 in artificial neural networks and has since supervised 16 completed PhDs in neural networks, evolutionary computation and probabilistic modelling. He is on the Editorial Board of several neural network and wider computational intelligence journals, and has been Honorary Chair of several international conferences. He has published over 300 refereed conference and journal papers, many book chapters and three books and is Series Co-Editor of the series "Computational Intelligence: Theory and Applications" with IGI International. He has given plenary talks at several international conferences and been visiting professor at universities in Australia, Korea, China, Taiwan and Spain. He is currently a Personal Professor at the University of the West of Scotland.

Plenary Lecture 5

Formalisation and Verification in a Type-theoretic Framework

Professor Zhaohui Luo
Dept. of Computer Science
Royal Holloway, Univ of London, UK

Abstract: Dependent type theory provides a powerful logical calculus for computer-assisted formal reasoning. The associated technology of theorem proving has produced very useful tools, the so-called "proof assistants", for formal proof development both in verification of programs and in formalisation of mathematics.
After giving an overview of the research field, I shall present a new type-theoretic framework LTT and explain its use in formalisation and verification. The particular features of the LTT framework include:
- LTT is a foundational calculus for formal reasoning with different logical foundations, establishing the basis for wider applications of the type theory based theorem proving technology.
- LTT employs a notion of "typed set", combining type-theoretical reasoning with set-theoretical reasoning in an effective way and supporting efficient proof development in formalisation and verification.
As a promising framework, LTT has been used in several case studies, including the formalisation of Weyl's predicative mathematics and the analysis of security protocols.

Brief Biography of the Speaker: Zhaohui Luo is Professor of Computer Science at Royal Holloway, University of London. He has obtained the PhD degree in Computer Science at University of Edinburgh and worked as Lecturer, Reader and Professor in University of Durham, before going to Royal Holloway. Luo's research interests in the last twenty years have focussed on the study of type theory and its applications. His publications include two authored books on type theory and programming methodology.

Authors Index

Abdul Aziz, S. 140
Ahmad, I. 225, 249
Al-Mahdi, H. 140
Andreotti, F. 168
Angelopoulos, J. D. 122
Anou, A. 209
Aruland, P. 45
Arzoumanidis, E. 49, 91
Askar, M. 23
Asoodeh, S. 220, 231
235, 253
Atani, R. E. 107
Baboli, M. 107
Bank, M. 214
Bensebti, M. 209
Blackledge, J. 35
Chamund, D. 65
Cho, S. I. 97, 113
157, 192
Cho, Y.-J. 40
Choi, D.-K. 40, 60
Choi, S.-Y. 118
Chung, J.-G. 97
Ciulli, N. 168
Corcau, J. I. 28
Curado, M. 168
Dargahi, A. A. 253
Datta, S. 35
Dhivya, R. 54
Djebari, M. 209
Dokouzyannis, S. 49, 73, 79
85, 91
El-Gabali, M. 140
Farooq, O. 35
Fyfe, C. 15
Hameed, F. 249
Haridim, M. 214
Harjula, I. 244
Hashmani, M. 202
Ismailoglu, A. N. 23
Jayanthi, J. G. 196
Jeong, H.-G. 118
Jeong, K. S. 113
Jovkovic, S. 129
Jung, J. H. 60
Jung, K.-S. 97
Kacprzyk, J. 13
Kadim, H. J. 19
Kandus, G. 162
Kapacinovic, N. 129
Katz, M. 244
Kechagias, A. 85
Khan, S. A. 187
Khan, U. S. 187
Kim, J.-B. 157
Kim, K. J. 113
Kim, M. H. 60
Kim, Y.-B. 40, 60
Kim, Y.-E. 97
Krstic, D. 129
Kumar, M. 146
Kuri-Morales, A. 14
Lai, X. 31
Landi, G. 168
Latheef, F. 54
Lee, J.-K. 40
Leligou, H.-C. 122
Libnik, R. 162
Luo, Z. 16
Martinez, F. 244
Mehdi, M. 209
Memon, M. S. 202
Memon, N. A. 202
Mirzakuchaki, S. 107
Mokios, A. 73, 79
Munir, S. 225
Nam, S.-H. 182
Nardini, C. 168
Nassar, H. 140
Niculescu, E. 133
Niculescu, M.-C. 133
Noimanee, S. 239
Orphanoudakis, T. 122
Park, K. C. 192
Polo, V. 244
Rabara, S. A. 196
Raghavan, N. 54
Rajendran, N. 196
Ramirez, A. 244
Ryu, D.-H. 182
Sakthivel, S. 177
Sanjeevi, V. K. 177
Sethi, G. 146
Shammas, N. Y. A. 65
Shanmugam, A. 45
Shin, J.-H. 40
Shriramwar, S. S. 101
Siriwitayakorn, K. 239
Stefanovic, M. 129
Stoenescu, E. 28
Supriya, M. 177
Svigelj, A. 162
Tunkasiri, T. 239
Tuntrakoon, J. 239
Veluchandhar 177
Xu, D. 31
Zadeh, L. A. 11
Zorrilla, D. 244