Recent Advances in Biomedical & Chemical Engineering and Materials Science

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Proceedings of the 2014 International Conference on Chemical Engineering and Materials Science (CEMS '14)

Proceedings of the 2014 International Conference on Biology and Biomedical Engineering (BBE '14)

Venice, Italy, March 15-17, 2014

Edited by

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John Gordon Lindsay
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Table of Contents

Keynote Lecture 1

On the Distinguished Role of the Mittag-Leffler and Wright Functions in Fractional Calculus

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Abstract: Fractional calculus, in allowing integrals and derivatives of any positive real order (the term "fractional" is kept only for historical reasons), can be considered a branch of mathematical analysis which deals with integro-di erential equations where the integrals are of convolution type and exhibit (weakly singular) kernels of power-law type. As a matter of fact fractional calculus can be considered a laboratory for special functions and integral transforms. Indeed many problems dealt with fractional calculus can be solved by using Laplace and Fourier transforms and lead to analytical solutions expressed in terms of transcendental functions of Mittag-Leffler and Wright type. In this plenary lecture we discuss some interesting problems in order to single out the role of these functions. The problems include anomalous relaxation and diffusion and also intermediate phenomena.

Brief Biography of the Speaker: For a full biography, list of references on author's papers and books see:
Home Page: http://www.fracalmo.org/mainardi/index.htm
and http://scholar.google.com/citations?user=UYxWyEEAAAAJ&hl=en&oi=ao

Keynote Lecture 2

Latest Advances in Neuroinformatics and Fuzzy Systems

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Abstract: Investigations into the neurophysiological foundations of neural networks in neuroinformatics [Wang, 2013] have led to a set of rigorous mathematical models of neurons and neural networks in the brain using contemporary denotational mathematics [Wang, 2008, 2012]. A theory of neuroinformatics is recently developed for explaining the roles of neurons in internal information representation, transmission, and manipulation [Wang & Fariello, 2012]. The formal neural models reveal the differences of structures and functions of the association, sensory and motor neurons. The pulse frequency modulation (PFM) theory of neural networks [Wang & Fariello, 2012] is established for rigorously analyzing the neurosignal systems in complex neural networks. It is noteworthy that the Hopfield model of artificial neural networks [Hopfield, 1982] is merely a prototype closer to the sensory neurons, though the majority of human neurons are association neurons that function significantly different as the sensory neurons. It is found that neural networks can be formally modeled and manipulated by the neural circuit theory [Wang, 2013]. Based on it, the basic structures of neural networks such as the serial, convergence, divergence, parallel, feedback circuits can be rigorously analyzed. Complex neural clusters for memory and internal knowledge representation can be deduced by compositions of the basic structures.

Fuzzy inferences and fuzzy semantics for human and machine reasoning in fuzzy systems [Zadeh, 1965, 2008], cognitive computers [Wang, 2009, 2012], and cognitive robots [Wang, 2010] are a frontier of cognitive informatics and computational intelligence. Fuzzy inference is rigorously modeled in inference algebra [Wang, 2011], which recognizes that humans and fuzzy cognitive systems are not reasoning on the basis of probability of causations rather than formal algebraic rules. Therefore, a set of fundamental fuzzy operators, such as those of fuzzy causality as well as fuzzy deductive, inductive, abductive, and analogy rules, is formally elicited. Fuzzy semantics is quantitatively modeled in semantic algebra [Wang, 2013], which formalizes the qualitative semantics of natural languages in the categories of nouns, verbs, and modifiers (adjectives and adverbs). Fuzzy semantics formalizes nouns by concept algebra [Wang, 2010],

verbs by behavioral process algebra [Wang, 2002, 2007], and modifiers by fuzzy semantic algebra [Wang, 2013]. A wide range of applications of fuzzy inference, fuzzy semantics, neuroinformatics, and denotational mathematics have been implemented in cognitive computing, computational intelligence, fuzzy systems, cognitive robotics, neural networks, neurocomputing, cognitive learning systems, and artificial intelligence.

Brief Biography of the Speaker: Yingxu Wang is professor of cognitive informatics and denotational mathematics, President of International Institute of Cognitive Informatics and Cognitive Computing (ICIC, http://www.ucalgary.ca/icic/) at the University of Calgary. He is a Fellow of ICIC, a Fellow of WIF (UK), a P.Eng of Canada, and a Senior Member of IEEE and ACM. He received a PhD in software engineering from the Nottingham Trent University, UK, and a BSc in Electrical Engineering from Shanghai Tiedao University. He was a visiting professor on sabbatical leaves at Oxford University (1995), Stanford University (2008), University of California, Berkeley (2008), and MIT (2012), respectively. He is the founder and steering committee chair of the annual IEEE International Conference on Cognitive Informatics and Cognitive Computing (ICCI*CC) since 2002. He is founding Editor-in-Chief of International Journal of Cognitive Informatics and Natural Intelligence (IJCINI), founding Editor-in-Chief of International Journal of Software Science and Computational Intelligence (IJSSCI), Associate Editor of IEEE Trans. on SMC (Systems), and Editor-in-Chief of Journal of Advanced Mathematics and Applications (JAMA). Dr. Wang is the initiator of a few cutting-edge research fields or subject areas such as denotational mathematics, cognitive informatics, abstract intelligence (□I), cognitive computing, software science, and basic studies in cognitive linguistics. He has published over 160 peer reviewed journal papers, 230+ peer reviewed conference papers, and 25 books in denotational mathematics, cognitive informatics, cognitive computing, software science, and computational intelligence. He is the recipient of dozens international awards on academic leadership, outstanding contributions, best papers, and teaching in the last three decades.

http://www.ucalgary.ca/icic/

http://scholar.google.ca/citations?user=gRVQjskAAAAJ&hl=en

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Keynote Lecture 3

Recent Advances and Future Trends on Atomic Engineering of III-V Semiconductor for Quantum Devices from Deep UV (200nm) up to THZ (300 microns)

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Abstract: Nature offers us different kinds of atoms, but it takes human intelligence to put them together in an elegant way in order to realize functional structures not found in nature. The so-called III-V semiconductors are made of atoms from columns III (B, Al, Ga, In. Tl) and columns V(N, As, P, Sb,Bi) of the periodic table, and constitute a particularly rich variety of compounds with many useful optical and electronic properties. Guided by highly accurate simulations of the electronic structure, modern semiconductor optoelectronic devices are literally made atom by atom using advanced growth technology such as Molecular Beam Epitaxy (MBE) and Metal Organic Chemical Vapor Deposition (MOCVD). Recent breakthroughs have brought quantum engineering to an unprecedented level, creating light detectors and emitters over an extremely wide spectral range from 0.2 mm to 300 mm. Nitrogen serves as the best column V element for the short wavelength side of the electromagnetic spectrum, where we have demonstrated III-nitride light emitting diodes and photo detectors in the deep ultraviolet to visible wavelengths. In the infrared, III-V compounds using phosphorus ,arsenic and antimony from column V ,and indium, gallium, aluminum, ,and thallium from column III elements can create interband and intrsuband lasers and detectors based on quantum-dot (QD) or type-II superlattice (T2SL). These are fast becoming the choice of technology in crucial applications such as environmental monitoring and space exploration. Last but not the least, on the far-infrared end of the electromagnetic spectrum, also known as the terahertz (THz) region, III-V semiconductors offer a unique solution of generating THz waves in a compact device at room temperature. Continued effort is being devoted to all of the above mentioned areas with the intention to develop smart technologies that meet the current challenges in environment, health, security, and energy. This talk will highlight my contributions to the world of III-V semiconductor Nano scale optoelectronics. Devices from deep UV-to THz.

Brief Biography of the Speaker: Manijeh Razeghi received the Doctorat d'État es Sciences Physiques from the Université de Paris, France, in 1980.
After heading the Exploratory Materials Lab at Thomson-CSF (France), she joined Northwestern University, Evanston, IL, as a Walter P. Murphy Professor and Director of the Center for

Quantum Devices in Fall 1991, where she created the undergraduate and graduate program in solid-state engineering. She is one of the leading scientists in the field of semiconductor science and technology, pioneering in the development and implementation of major modern epitaxial techniques such as MOCVD, VPE, gas MBE, and MOMBE for the growth of entire compositional ranges of III-V compound semiconductors. She is on the editorial board of many journals such as Journal of Nanotechnology, and Journal of Nanoscience and Nanotechnology, an Associate Editor of Opto-Electronics Review. She is on the International Advisory Board for the Polish Committee of Science, and is an Adjunct Professor at the College of Optical Sciences of the University of Arizona, Tucson, AZ. She has authored or co-authored more than 1000 papers, more than 30 book chapters, and fifteen books, including the textbooks Technology of Quantum Devices (Springer Science+Business Media, Inc., New York, NY U.S.A. 2010) and Fundamentals of Solid State Engineering, 3rd Edition (Springer Science+Business Media, Inc., New York, NY U.S.A. 2009). Two of her books, MOCVD Challenge Vol. 1 (IOP Publishing Ltd., Bristol, U.K., 1989) and MOCVD Challenge Vol. 2 (IOP Publishing Ltd., Bristol, U.K., 1995), discuss some of her pioneering work in InP-GaInAsP and GaAs-GaInAsP based systems. The MOCVD Challenge, 2nd Edition (Taylor & Francis/CRC Press, 2010) represents the combined updated version of Volumes 1 and 2. She holds 50 U.S. patents and has given more than 1000 invited and plenary talks. Her current research interest is in nanoscale optoelectronic quantum devices.

Dr. Razeghi is a Fellow of MRS, IOP, IEEE, APS, SPIE, OSA, Fellow and Life Member of Society of Women Engineers (SWE), Fellow of the International Engineering Consortium (IEC), and a member of the Electrochemical Society, ACS, AAAS, and the French Academy of Sciences and Technology. She received the IBM Europe Science and Technology Prize in 1987, the Achievement Award from the SWE in 1995, the R.F. Bunshah Award in 2004, and many best paper awards.