Recent Advances in Applied Mathematics and Computational Methods

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Proceedings of the 2013 International Conference on Applied Mathematics and Computational Methods (AMCM 2013)

September 28-30, 2013, Venice, Italy

Edited by

Metin Demiralp
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Gen Qi Xu

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Keynote Lecture 1

Ant Decision Systems for Combinatorial Optimization with Binary Constraints

Professor Nicolas Zufferey
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Abstract: In this paper is considered a problem (P) which consists in minimizing an objective function f while satisfying a set of binary constraints. Function f consists in minimizing the number of constraints violations. Problem (P) is NP-hard and has many applications in various fields (e.g., graph coloring, frequency assignment, satellite range scheduling). On the contrary to exact methods, metaheuristics are appropriate algorithms to tackle medium and large sized instances of (P). A specific type of ant metaheuristics is designed to tackle (P), where in contrast with state-of-the-art ant algorithms, an ant is a decision helper and not a constructive procedure.

Brief Biography of the Speaker: Swiss citizen, Nicolas Zufferey is Professor of Operations Management at the University of Geneva. He holds a PhD in Operations Research from EPFL.
His research and publications relate to the heuristics, operations research, optimization, logistics management and quantitative management methods.

The full paper of this lecture can be found on page 260 of the present volume, as well as in the CD-ROM proceedings.

Keynote Lecture 2

A New Framework for the Robust Design of Analog Blocks Using Conic Uncertainty Budgeting

Professor Claudio Talarico
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Abstract: In nanoscale technologies process variability makes it extremely difficult to predict the behavior of manufactured integrated circuits (IC). The problem is especially exacerbated in analog IC where long design cycles, multiple manufacturing iterations, and low performance yields causes only few design to have the volume required to be economically viable. This paper presents a new framework that accounts for process variability by mapping the analog design problem into a robust optimization problem using a conic uncertainty model that dynamically adjust the level of conservativeness of the solutions through the introduction of the notion of budget of uncertainty. Given a yield requirement, the framework implements uncertainty budgeting by linking the yield with the size of the uncertainty set associated to the process variations depending on the design point of interest. Dynamically adjusting the size of the uncertainty set the framework is able to find a larger number of feasible solutions compared to other robust optimization frameworks based on the well known ellipsoidal uncertainty (EU) model. To validate the framework, we applied it to the design of a 90nm CMOS differential pair amplifier and compared the results with those obtained using the EU approach. Experimental results indicate that the proposed Conic Uncertainty with Dynamic Budgeting (CUDB) approach attain up to 18% more designs meeting target yield.

Brief Biography of the Speaker: Claudio Talarico is Associate Professor of Electrical and Computer Engineering at Gonzaga University. He holds a PhD degree in electrical engineering from University of Hawaii where he conducted research in the area of Embedded System-on-Chip. Before joining Gonzaga University, he worked at Eastern Washington University, University of Arizona, University of Hawaii, and in industry where he held both engineering and management positions in the area of VLSI integrated circuits. The companies he worked for include Infineon Technologies, in Sophia Antipolis, France, IKOS Systems in Cupertino, CA and Marconi Communications, in Genova, Italy.

The full paper of this lecture can be found on page 49 of the Proceedings of the 2013 International Conference on Electronics, Signal Processing and Communication Systems, as well as in the CD-ROM proceedings.

Keynote Lecture 3

On Mutual Relations Between Bioinspired Algorithms, Deterministic Chaos and Complexity

Professor Ivan Zelinka
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Abstract: This lecture is focused on mutual intersection of three interesting fields of research i.e. bioinspired algorithms, deterministic chaos and complexity, introducing a novel approach joining bioinspired dynamics, complex networks and CML systems exhibiting chaotic behavior. The first part will discuss a novel method on how dynamics of bioinspired algorithms can be visualized in the form of complex networks. An analogy between individuals in the populations in an arbitrary bioinspired algorithm and the vertices in a complex network will be discussed as well as the relationship between the communications of individuals in a population and the edges in a complex network. The second part will discuss the possibility of how to visualize the dynamics of a complex network by means of coupled map lattices and to control by means of chaos control techniques. The last part will discuss some possibilities on CML systems control, especially by means of bioinspired algorithms. The spirit of this keynote speech is to create a closed loop in the following schematic: bioinspired dynamics --> complex network --> CML system --> control CML --> control bioinspired dynamics. Real-time simulations as well as animations and pictures demonstrating the presented ideas will be presented through this lecture.

Brief Biography of the Speaker: Ivan Zelinka is currently working at the Technical University of Ostrava (VSB-TU), Faculty of Electrical Engineering and Computer Science. He graduated consequently at Technical University in Brno (1995 - MSc.), UTB in Zlin (2001 - Ph.D.) and again at Technical University in Brno (2004 - assoc. prof.) and VSB-TU (2010 - professor). Before academic career he was an employed like TELECOM technician, computer specialist (HW+SW) and Commercial Bank (computer and LAN supervisor).
During his career at UTB he proposed and opened 7 different lectures. He also has been invited for lectures at 7 universities in different EU countries plus role of the keynote speaker at the Global Conference on Power, Control and Optimization in Bali, Indonesia (2009), Interdisciplinary Symposium on Complex Systems (2011), Halkidiki, Greece and IWCFTA 2012, Dalian China. He is and was responsible supervisor of 3 grant of fundamental research of Czech grant agency GAČR, co-supervisor of grant FRVŠ - Laboratory of parallel computing. He was also working on numerous grants and two EU project like member of team (FP5 - RESTORM) and supervisor (FP7 - PROMOEVO) of the Czech team.
Currently he is professor at the Department of Computer Science and in total he has been supervisor of more than 30 MSc. and 20 Bc. diploma thesis. Ivan Zelinka is also supervisor of doctoral students including students from the abroad. He was awarded by Siemens Award for

his Ph.D. thesis, as well as by journal Software news for his book about artificial intelligence. Ivan Zelinka is a member of British Computer Socciety, Editor in chief of Springer book series: Emergence, Complexity and Computation, Editorial board of Saint Petersburg State University Studies in Mathematics, Machine Intelligence Research Labs (MIR Labs - http://www.mirlabs.org/czech.php), IEEE (committee of Czech section of Computational Intelligence), a few international program committees of various conferences and international journals (Associate Editor of IJAC, Editorial Council of Security Revue, http://www.securityrevue.com/editorial-council/). He is author of journal articles as well as of books in Czech and English language.