ADVANCED ROBOTICS, CONTROL & ADVANCED MANUFACTURING SYSTEMS

Editors:
Prof. Shengyong Chen, Zhejiang University of Technology
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Proceedings of the 9th WSEAS International Conference on ROBOTICS, CONTROL and MANUFACTURING TECHNOLOGY (ROCOM'09)

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Preface

This year the 8th WSEAS International Conference on Instrumentation, Measurement, Circuits and Systems (IMCAS'09) was held in Hangzhou, China. The Conference remains faithful to its original idea of providing a platform to discuss modelling, analysis and simulation, kinematics, dynamics and control of robots, robotics materials, robotics languages, human-robot interfaces, motion and path planning etc. with participants from all over the world, both from academia and from industry.

Its success is reflected in the papers received, with participants coming from several countries, allowing a real multinational multicultural exchange of experiences and ideas.

The accepted papers of this conference are published in this Book that will be indexed by ISI. Please, check it: www.worldses.org/indexes as well as in the CD-ROM Proceedings. They will be also available in the E-Library of the WSEAS. The best papers will be also promoted in many Journals for further evaluation.

A Conference such as this can only succeed as a team effort, so the Editors want to thank the International Scientific Committee and the Reviewers for their excellent work in reviewing the papers as well as their invaluable input and advice.

The Editors

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Plenary Lecture 1

Neuro-dynamic Optimization and Its Applications in Robotics

Professor Jun Wang
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Hong Kong

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Abstract: Optimization problems arise in a wide variety of scientific and engineering applications. It is computationally challenging when optimization procedures have to be performed in real time to optimize the performance of dynamical systems. For such applications, classical optimization techniques may not be competent due to the problem dimensionality and stringent requirement on computational time. One very promising approach to dynamic optimization is to apply artificial neural networks. Because of the inherent nature of parallel and distributed information processing in neural networks, the convergence rate of the solution process is not decreasing as the size of the problem increases. Neural networks can be implemented physically in designated hardware such as ASICs where optimization is carried out in a truly parallel and distributed manner. This feature is particularly desirable for dynamic optimization in decentralized decision-making situations arising frequently in robotics. In this talk, I will present the historic review and the state of the art of neurodynamic optimization models and selected applications in robotics. Specifically, starting from the motivation of neurodynamic optimization, I will review various recurrent neural network models for optimization. Theoretical results about the stability and optimality of the neurodynamic optimization models will be given along with illustrative examples and simulation results. It will be shown that many problems in intelligent robotic systems, such as robot motion planning grasping force optimization, can be readily solved by using the neurodynamic optimization models.

Brief Biography of the Speaker: Jun Wang is a Professor and the Director of Computational Intelligence Laboratory in the Department of Mechanical and Automation Engineering at the Chinese University of Hong Kong. Prior to this position, he held various academic positions at Dalian University of Technology, Case Western Reserve University, and University of North Dakota. Besides, he also holds a Cheung Kong Chair Professorship in computer science and engineering at Shanghai Jiao Tong University since 2008. He received a B.S. degree in electrical engineering and an M.S. degree in systems engineering from Dalian University of Technology, Dalian, China. He received his Ph.D. degree in systems engineering from Case Western Reserve University, Cleveland, Ohio, USA. His current research interests include neural networks and their applications. He published over 140 journal papers, 11 book chapters, 8 edited books, and numerous conference papers in the areas. He is an Associate Editor of the IEEE Transactions on Neural Networks since 1999 and IEEE Transactions on Systems, Man, and Cybernetics – Part B since 2003, a member of the Editorial Advisory Board of the International Journal of Neural System since 2006. He also served as an Associate Editor of the IEEE Transactions on Systems, Man, and Cybernetics – Part C (2002-2005), a guest editor of the special issue of European Journal of Operational Research (1996), International Journal of Neural Systems (2007), and Neurocomputing (2008), He was an organizer of several international conferences such as the General Chair of the 13th International Conference on Neural Information Processing (2006) and the 2008 IEEE World Congress on Computational Intelligence. He served as the President of Asia Pacific Neural Network Assembly in 2006 and as a member of several IEEE technical committees over the years. He is an IEEE Fellow.

Plenary Lecture 2

On the Control Theory of the Sylvester Differential and Difference Systems

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Abstract: Sylvester equations play an important role in many areas of applied mathematics and specifically in control systems theory. In this talk, we focus on the controllability and absorbability studies on the Sylvester differential system in the following general form

$$T'(t)=A(t)T(t)B(t) + C(t)T(t)D(t) + E(t)U(t)$$

and its discrete analogue. The closed form solutions of the matrix differential and difference systems and their implications to the control systems are discussed over the cases when the systems are time-variant and time-invariant. Some open problems are discussed at the conclusion of the talk.

Brief Biography of the Speaker: Yan Wu received the B.S. degree in Mathematics from Beijing University of Technology in 1992, and the Ph.D. degree in Applied Mathematics and Electrical Engineering both from University of Akron in 1996 and 2000, respectively.
Currently he is an Associate Professor in the Department of Mathematical Sciences at Georgia Southern University. His research interests include numerical linear algebra, nonlinear control, and generalized sampling theory. He has two patents granted by the United States Patent and Trademark Office. One of his papers was ranked 4th place among the top 25 publications in the Journal of Digital Signal Processing in 2006. Dr. Wu serves as an Associate Editor for Instrumentation, Systems, and Automation (ISA) and American Automatic Control Council (AACC).

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