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Recent Advances and Applications of Electrical Engineering

Proceedings of the 9th WSEAS International Conference on Applications of Electrical Engineering (AEE '10)

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Universiti Kebangsaan
Malaysia

Penang, Malaysia, March 23-25, 2010

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Preface

This year the 9th WSEAS International Conference on APPLICATIONS of ELECTRICAL ENGINEERING (AEE '10) was held in Penang, Malaysia, March 23-25, 2010. The conference remains faithful to its original idea of providing a platform to discuss hardware systems, software engineering, computational intelligence, communications, computer networks, computer applications in biomedicine, nuclear physics, environmental science and development, geoscience, plasma and fusion, astrophysics, optics, naval and marine engineering, acoustics and music, remote sensing, chemistry and chemical engineering 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

Fuzzy Dynamic Modeling for Walking Modular Robot Control

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Abstract: The paper presents new concepts and approaches of multi-stage fuzzy method of walking modular robots using resolved acceleration control. Several compliant control methods were analyzed in order to obtain high performances in robot trajectory control, which generates position and force parameters for multi-stage fuzzy control, some of which include a dynamic model in loop control: control with the settled acceleration (Luh, Walker and Paul 1980), operational space method (Khatib 1980;1987), impedance control (Kazerooni, Houpt and Sheridan 1986), and some of which not include dynamic model: hybrid control (Railbert and Craig) and rigidity control (Salisbury 1980). Stability analysis and experimental implementation are presented, which demonstrate not only that by using dynamic models is achieved a more accurate control, but also that using a inadequate dynamic model can lead to a unstable control of the force in some cases. For real-time control of robot stability the mathematical modeling of the center of gravity position was realized, in order to allow control of the walking robot when moving on terrains with complicated configuration, and relations for robot position coordinates of the center of gravity were established which are necessary. Modified control by resolved acceleration or operational space method is stable because the inertia matrix is also included canceling the destabilizing effects of the inverse Jacobian. The control system architecture by dynamic models through fuzzy multi-stage method is presented where control method through resolved acceleration had been chosen as compliant control method. The results of the rules base analysis are presented, in which the loop reaction for force is dependant on the values of inference from fuzzy control of component P together with a set of membership functions for inputs and outputs. Choosing a universe of discreet discourse allows the using of PLC system from control system architecture of the HFPC modular walking robots, in order to generate fuzzy output variables in a reduced processing time. The studies presented have demonstrated the possibility of implementing force control by resolved acceleration where dynamics and kinematics stability are simultaneously achieved in rigid environments. The obtained results lead to a smooth transition, in walking robots movement, without discontinuities, from controlling in position to controlling in force and position. Furthermore, we achieve a fast response of control loop maintaining robot stability in the process of stepping on uneven ground.

Brief Biography of the Speaker:
Luige Vladareanu received his M.Sc. degree in electronics from the Polytechnic Institute Bucharest, in 1977. From 1984, scientific researcher of the Institute of Physics and Material Technology, from 1990, team leader of data acquisition systems and real time control systems of the Institute of Solid Mechanics, from 1991, President General Manager of Engineering and Technology Industrial VTC company. In 1998 he received Ph.D. degree in electronics field from the Institute of Solid Mechanics of Romanian Academy. From 2003, Ministry of Education and Research, executive Department for Financing Superior Education and of Scientific University Research - High Level Expert Consulting for MEC/CNCSIS project, from 2003-2005, member of Engineering Science Committee of Romanian National Research Council, from 2005, Scientific Researcher Gr.I (Professor) of Romanian Academy. His scientific work is focused on real time control in solid mechanics applied in robot trajectory control, hybrid position – force control, multi-microprocessor systems for robot control, acquisition and processing of experimental physical data, experimental methods and signal processing, nano-micro manipulators, semi-active control of mechanical system vibrations, semi-active control of magnetorheological dissipaters systems, complex industrial automations with programmable logical controllers in distributed and decentralized structure. He has published 4 books, over 20 book chapters, 11 edited books, over 200 papers in journals, proceedings and conferences in the areas. Director and coordinator of 7 grants of national research – development programs in the last 5 years, 15 invention patents, developing 17 advanced work methods resulting from applicative research activities and more then 60 research projects. In 1985 the Central Institute of Physics Bucharest awarded his research team a prise for the first Romanian industrial painting robot. He is the winner of the two Prize and Gold of Excellence in Research 2000, SIR 2000, of the Romanian Government and the Agency for Science, Technology and Innovation. 3 International Invention and Innovation Competition Awards and Gold of World's Exhibition of Inventions, Geneva 2007 and 2008, and other 7 International Invention Awards and Gold of the Brussels, Croatia, Bucharest International Exhibition. He received "Traian Vuia" (2006) award of the Romanian Academy, Romania's highest scientific research forum, for a group of scientific papers published in the real time control in the solid mechanics. He is a member of the International Institute

of Acoustics and Vibration (IIAV), Auburn University, USA (2006), ABI/s Research Board of Advisors, American Biographical Institute (2006), World Scientific and Engineering Academy Society, WSEAS (2005), International Association for Modelling and Simulation Techniques in Enterprises-AMSE, France (2004), National Research Council from Romania(2003-2005), etc. He was an organizer of several international conferences such as the General Chair of four WSEAS International Conferences (http://www.wseas.org/conferences/2008/romania/amta/index.html) and is serving on various other conferences and academic societies.

Plenary Lecture 2

Developments and Applications of Adaptive Cerebellar Model Articulation Controllers

Professor Chih-Min Lin
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Abstract: Based on biological prototype of human brain and improved understanding of the functionality of the neurons and the pattern of their interconnections in the brain, a theoretical model used to explain the information-processing characteristics of the cerebellum was developed independently by Marr (1969) and Albus (1971). Cerebellar model articulation controller (CMAC) was first proposed by Albus in 1974. CMAC is a learning structure that imitates the organization and functionality of the cerebellum of the human brain. That model revealed the structure and functionality of the various cells and fibers in the cerebellum. The core of CMAC is an associative memory which has the ability to approach complex nonlinear functions. CMAC takes advantage of the input-redundancy by using distributed storage and can learn nonlinear functions extremely quickly due to the on-line adjustment of its system parameters. CMAC is classified as a non-fully connected perceptron-like associative memory network with overlapping receptive-fields. It has good generalization capability and fast learning property and is suitable for a lot of applications. This speech introduces several CMAC-based adaptive learning systems; these systems combine the advantages of CMAC identification, adaptive learning and control techniques. In these systems, the on-line parameter training methodologies, using the gradient descent method and the Lyapunov stability theorem, are proposed to increase the learning capability. Moreover, the applications of these systems in servomotor control, biped robot and computer-aided diagnostic of breast nodules are demonstrated.

Brief Biography of the Speaker:
Prof. Chih-Min Lin is currently a Professor of Electrical Engineering, Yuan Ze University, Taiwan. He also serves as the Editor-in-Chief of WSEAS Trans. Systems and Control and Associate Editor of IEEE Trans. Systems, Man, and Cybernetics, Part B; Asian Journal of Control; and International Journal of Fuzzy Systems.. He is now the Chair of IEEE Computational Intelligence Society, Taipei Chapter, and Board of Government of IEEE Taipei Section. His research interests include fuzzy systems, neural network, cerebellar model articulation controller, and intelligent control systems. He is an IEEE Fellow and IET Fellow. He has published 93 journal papers and 134 conference papers.

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