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CONTROL SYSTEMS



Proceedings of the 4th WSEAS/IASME International Conference on
DYNAMICAL SYSTEMS and CONTROL (CONTROL'08)

Corfu, Greece, October 26-28, 2008

Mathematics and Computers in Science and Engineering
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Preface

This book contains the proceedings of the 4th WSEAS/IASME International Conference on DYNAMICAL SYSTEMS and CONTROL (CONTROL'08) which was held in Corfu, Greece, October 26-28, 2008. This conference aims to disseminate the latest research and applications in Dynamical systems, Differential Equations, Non-linear Structures, Mathematical Theory of Control, Non-Linear Control, Discrete Event Systems and other relevant topics and applications.

The friendliness and openness of the WSEAS conferences, adds to their ability to grow by constantly attracting young researchers. The WSEAS Conferences attract a large number of well-established and leading researchers in various areas of Science and Engineering as you can see from <http://www.wseas.org/reports>. Your feedback encourages the society to go ahead as you can see in <http://www.worldses.org/feedback.htm>

The contents of this Book are also published in the CD-ROM Proceedings of the Conference. Both will be sent to the WSEAS collaborating indices after the conference: www.worldses.org/indexes

In addition, papers of this book are permanently available to all the scientific community via the WSEAS E-Library.

Expanded and enhanced versions of papers published in this 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, ACM, 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). WSEAS has also collaboration with several other international publishers and all these excellent papers of this volume could be further improved, could be extended and could be enhanced for possible additional evaluation in one of the editions of these international publishers.

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

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Plenary Lecture I

Visualservoing for Tentacular Robots



Professor Dorian Cojocaru

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Abstract: The lecture deals with the theoretical and experimental research in a domain that is the result of two complex scientific subdomains interconnection: tentacular robotic structures on one hand and, computer vision systems on the other hand.

An ideal tentacle manipulator is a non-conventional robotic arm with an infinite mobility. It has the capability to take sophisticated shapes and to achieve any position and orientation in a 3D space. These systems are also known as hyperredundant manipulators and, over the past several years, there has been a rapidly expanding interest in the study and construction of them. The difficulty of the dynamic control is determined by integral-partial-differential models with high nonlinearities that characterise the dynamic of these systems.

The subjects of the lecture are set out after the following directions: cinematic and dynamic model design for tentacular robots, visual servoing techniques, methods and algorithms design for tentacular robots, computer vision techniques, methods and algorithms design for tentacular robots control, interactive graphical environment design and implementation for application development, experimental models, results scientific validation and use.

Brief Biography of the Speaker: Dorian Cojocaru graduated from University of Craiova in 1983, receiving the 5 years Engineering Diploma in Automation, specialization Computer Engineering; He received the Ph.D. in Automation from the Romanian Ministry of Education in 1997. He is active as a full university professor to the Automation and Robotics Department. He serves as the Vice Dean of the Faculty of Automation, Computers and Electronics and member of the Senate of University of Craiova Romania. He is a fellow of IEEE Robotics and Automation Society, IEEE Computer Society, Romanian Society for Automation and Technical Informatics SRAIT, Romanian Society for Robotics SRR, Romanian Association for Electronics Industry and Software ARIES. He is acting as expert for Romanian Agency for Quality Assurance in Higher Education ARACIS, Romanian National University Research Council CNCSIS, Romanian National Authority for Scientific Research ANCS, Romanian Ministry of Education, Research and Youth MECT and EU Seventh Framework Programme. Dorian Cojocaru has served as Chairman and member of the Scientific/Program Committees of numerous scientific national and international conferences. His present areas of research activity are: Computer Vision, Visual servoing, Robotics and Applied Informatics. He has published five books, more than 100 papers in various scientific journals and international conference proceedings and he coordinated more than 10 research national and international programs.

Plenary Lecture II

On Distributions Theory with Control Engineering Applications



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Abstract: This paper presents an innovative approach on classical distributions theory, insisting on very practical applications in digital control engineering. The distributions theory was years ago only an interesting mathematical instrument, rarely used in engineering applications. As it is well known, many times when we have to solve complex control problems, we encounter difficulties in writing the mathematical models for the analyzed process. The real world phenomena cannot be always represented as mathematical closed formula. This is because the practical phenomena have discontinuities, severe nonlinearities and non-derivation points. In order to solve these problems using classical mathematics these regions are represented by partitioning method, eliminating this way the discontinuities and the use of derivation operator. The main disadvantages of this approach are: the mathematical model is complicated, the working points of the system that appear as discontinuities are eliminated, difficult to represent the equations for digital and/or nonlinear systems, cannot be used the differential equations etc. The distributions theory with its remarkable properties represents a link between the continuous systems with their vast experience and the digital systems with the above constraints. First, the paper presents the definition of elementary pulse and step distributions and their properties, which are validated by modeling and simulation. Then, starting from the elementary distributions, new distributions, theorems and properties are demonstrated, modeled and simulated with digital application examples. The final of the paper presents complex control engineering applications, like: Pulse Width Modulation (PWM) and Pulse Amplitude Modulation (PAM) digital controllers for power electronics, adaptive closed loop DC servo controller and water drain process nonlinear controller. All of these controllers based on distributions theory can be easily coded in any programming language. Moreover there can be used even a Hardware Description Language (HDL) as an ASIC embedded solution.

Brief Biography of the Speakers:

Emil Pop: graduated with BSc(Hons) in Electrical Engineering in 1967 and gained a PhD in System Control in 1975, based upon the research developed at the University La Sapienza, Rome, Italy and at the University of Petrosani. He joined in 1967 the University of Petrosani. In 1990 became Professor of System Control Engineering, Ph.D advisor and was for many years the Head of System Control and Applied Informatics Engineering Department. In 1993 he was for 4 years General Director in the Romanian Ministry of Education and Research and from 2008 he is the Rector of the University of Petrosani. In 2001 he was Visiting Professor at the University of Clausthal, Germany. In 2007 he was made Academician of the Technical Academy of Russia. His general research interests are in system control engineering, nonlinear systems, VLSI system design, robot control, modelling and simulation and applied informatics.

Monica Leba: received a BSc(Hons) in System Control and Applied Informatics Engineering in 1998, a MSc in Information Systems and Technologies in 2007 and gained a PhD in System Control in 2002. She joined in 1999 the University of Petrosani. In 2008 became Associated Professor of System Control Engineering. She is Director of European Program Centre of the University of Petrosani from 2008. In 2001 she achieved a research project at the University of Clausthal, Germany and in 2006 at the University of Florence, Italy. Her general research interests are in applied informatics, system control engineering, robot control, modelling and simulation and computer engineering.

Plenary Lecture III

Nonparametric Estimation for Control Engineering



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Abstract: The subject of this lecture is the application of nonparametric estimation methods – in particular statistical kernel estimators – for control engineering. Such methods allow the useful characterization of probability distributions without arbitrary assumptions regarding their membership to a fixed class. A detailed description of the Bayes parameter estimation with asymmetrical polynomial loss function will be given, as will one for fault detection in dynamical systems as objects of automatic control, in the scope of detection, diagnosis and prognosis of malfunctions. To this aim the basics of data analysis and exploration tasks – identification of outliers, clustering, and classification – solved using uniform mathematical apparatus based on the kernel estimators methodology will also be considered. In every case the final result will be an algorithm ensuring that its practical implementation does not demand of the user detailed knowledge of the theoretical aspects, or laborious research and calculations.

Brief Biography of the Speaker: Piotr Kulczycki graduated with a Master's degree in Control Engineering from the AGH University of Science and Technology, and a Master's degree in Applied Mathematics (with honours) from the Jagiellonian University in 1983 and 1987, respectively. He then received the scientific degrees of Ph.D. and D.Sc. (habilitation) in Control Engineering from the AGH University of Science and Technology in 1991 and 1999, respectively, followed by the title of Professor in Technical Sciences at the Systems Research Institute of the Polish Academy of Sciences in 2005. He presently holds the professor positions at the Systems Research Institute of the Polish Academy of Sciences as well as the Cracow University of Technology, where he is the Head of the Department of Control Engineering. He has held the position of visiting professor at the Aalborg University and has given guest lectures at the Technical University of Budapest, the Helsinki University of Technology, the Université Catholique de Louvain, and the Tampere University of Technology.

Prof. Kulczycki has published 4 books and monographs and around 100 scientific works in reputable journals and international conference proceedings. These works have been quoted many times. He has also participated in 7 scientific research projects, 4 of which were conducted by international teams. The field of his scientific activity to date is the applicational aspects of information technology and data analysis and mining, mostly connected with the use of modern statistical methods and fuzzy logic in diverse issues of contemporary systems research and control engineering. He has also carried out research on artificial neural networks and the theory of differential equations. His avocational interests are centred on ancient and Napoleonic history, as well as classical music, gardening, and international tourism.

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