2012 9th France-Japan & 7th Europe-Asia Congress on Mechatronics (MECATRONICS 2012) / 13th International Workshop on Research and Education in Mechatronics

(REM 2012)

Paris, France
21-23 November 2012

Wednesday November 21

Registration *8h30 - 9h30*			
Opening session *D000 - 9h30 - 10h00*			
Kenji KANEKO (AIST) **Towards Emergency Response Humanoid Robots** *D000 - 10h00 - 11h00*			
Coffee Break			
Parallel sessions *11h30 - 13h00*			
Session A1 *D100* Education 1	Session A2 *D101* Actuators & sensors 1	Session A3 *D102* Modelling 1	Session A4 *D103* Transportation 1
LUNCH			
Philippe LUBINEAU (CETIM) **International Standardization in Mechatronics** *D000 - 14h30 - 15h30*			
Coffea Break			
Parallel sessions *16h00 - 17h30*			
Session B1 *D100* NMA 1	Session B2 *D101* Robotics 1	Session B3 *D102* Simulation 1	Session B4 *D103* Medical applications 1

Plenary session 10:00-11:00

Kenji KANEKO

Humanoid Research Group, Intelligent Systems Research Institute, National Institute of Ad
Industrial Science and Technology, Tsukuba, Japan

···Towards Emergency Response Humanoid Robots

This paper studies the feasibility of emergency response humanoid robots. The 2011 Tohoku Earthquake was tl
powerful earthquake ever measured in Japan. It is also referred to as the Great East Japan Earthquake and happened on
11, 2011. Following the earthquake, several tsunami hit the Pacific coast of eastern Japan and damaged the Ful
Daiichi Nuclear Power Plant. Some robots are deployed for emergency response, but there are several tasks that are
them to execute. The possibility of a humanoid robot that can assist in emergency recovery is discussed in this pape
mechanisms of the HRP series humanoid robots are also introduced.

Morning 11:30-13:00

Session A1: Education 1

Chairman: R. Dudziak, Bochum University of Applied Sciences

3: : "'Microcontroller Based Intelligent Platform for Research and Education in Mechatronics

R. Sell[1], S. Seiler[2], D. Ptasik[3]
[1]Tallinn University of Technology, Ehitajate tee 5, Tallinn, Estonia
[2]Bochum University of Applied Sciences, Bochum, Germany

The microcontroller based intelligent platform is a combination of technology and methodology developed for mechatronics education and research. Students can use the platform for mechatronics coursework and hands-on experiments not only in the university lab but also at home or whatever place they can imagine. Only an Internet connected computer is needed. At the same way university staff or researchers can run microcontroller based experiments over the web in case of complex algorithms where different sensors and actuators are involved and need to be tested. The paper introduces the methodology and associated technical concept as well as giving closer look to the hardware systems. Experience of applying the platform in Estonia and Germany is shortly summarized in the last chapter.

53; "Mechatronics Engineering at Polytechnic School of University of Sao Paulo : a Survey Analysis of Egress Alumni

A. Fernandes, B. Peixotoy, E. Moscatelliz, F. J. Oliveirax,
Diolino Jos´e Santos Filho and Giuliano Salcas Olguink
Polytechnic School of the University of Sao Paulo, Sao Paulo, Brazil

This paper presents some results obtained from an inquiry performed between 2003 and 2008 with Mechatronics Engineering alumni of the Polytechnic School of the University of Sao Paulo (EPUSP). The research method was based on an elaboration of evaluation tools, applied as a questionnaire. These were sent to a sample of 365 alumni. It was comprised by 49 questions related to professional experience and the undergraduate curriculum. It was applied online, through the platform "Moodle/Stoa", and the survey data were analyzed using the Statistical Package for the Social Sciences (SPSS) software. Through the results it was possible to collect information on subjects which have been fundamental for a Mechatronics engineer in different job areas. The main motivation for this research was to obtain the following information: if the course is appropriate considering the reality experienced by mechatronic engineers in the job market. They are one of the main sources of information on societal needs,in terms of technological and social development, as they are in direct contact to the evolution in the way of life. Therefore, one could expect the such acquired knowledge throughout their careers to be useful on the improvement of their Undergraduate Program, while making it more adequate to current society needs.

559"Development of Educational Environment for an Online Control of a Biped Robot using MATLAB and Arduino

Asiya M. Al-Busaidi
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This paper describes the development of innovative low-cost educational platform to study and control Bioloid biped robot in real-time using MATLAB and Arduino board. MATLAB was used as a control and visualization environment, while the Arduino board was utilized as a final controller for the servo motors as well as a Data Acquisition Card (DAC). However, it is important to recognize that there is much more knowledge to learn to control a robot, such as hardware (sensors, actuators) knowledge, software knowledge and control theory. But, it is important to emphasize that this paper is merely focused on the hardware and software development which can be utilized to accomplish many tasks like controlling the walking motion. Here the platform set up and the algorithm adopted in controlling the servos as well as reading from the sensors are described such that any student can reconstruct and start using it to understand his/her subject

Session A2: Actuators & Sensors 1
Chairman: P. Noskievic, VSB-Technical University of Ostrava

36"Development of Functional Force Solenoid Actuator

S. Obata, K. Kimura, Y. Saito*
Division of Electronic Mechanical Engineering, School of Science & Engineering,
Tokyo Denki University, Hatoyama, Hiki, Saitama, 350-0394, * Institute of Mechatronics Robotics
Kaedegaoka, Hatoyama, Hiki, Saitama, 350-0314

Antagonistic pairs of biarticular muscles are very important for human body motions. Actuators driving such muscle motions are needed for creating genuine humanoid robots. A system of actuators is designed using the solenoid linear actuators with the abilities to move realistic humanoid robots. The solenoid coils are devised with the theoretical calculations to produce functional forces depend on the stroke position, where actualized concrete actuators show the completely expected ability. These performances are based on developments of recent electro-magnetic materials and power modules.

36; "Influence of the grating of cones shape on the performances of fiberoptic linear displacement sensor

Z. El Rawashdeh, F. Lamarque, C. Prelle, P. Revel
Université de Technologie de Compiègne, Laboratoire Roberval UMR 7337, Centre Pierre Guillaumat, BP 60319,
60203 Compiègne, France

This paper introduces the principle of a new optical displacement sensor; its main characteristic is its ability to measure over long range (millimetric) with nanometric resolution the linear displacement of an actuator performing a helical movement. Firstly, the grating of cones principle is describded. Then, geometrical modeling is proposed. The influence of the shape of the cones over the sensor performances (range, sensitivity, resolution) is studied. Finally, the calibration curves in terms of the light intensity detected as a function of the displacement are compared when planar and convex surfaces are considered.

473"Development of the Miniature Hemispherical Tilt Stage Driven by Stick-slip Motion using Piezoelectric Actuators'"

Hiroaki Shiratori, Masato Takizawa, Yuuka Irie, Shinnosuke Hirata, and Hisayuki Aoyama
Dept. of Mechanical Engineering and Intelligent Systems, The University of Electro-Communications
1-5-1, Chofugaoka, Chofu, Tokyo, Japan

A miniature hemispherical stage has been proposed for improvement of microscopic observation and manipulation. The stage can be rotated in arbitrary direction under a scanning electron microscope (SEM). The stage is composed of a hemisphere and three drive units. Besides, the drive unit is composed of a drive ball and two piezoelectric actuators. The drive ball is moved by two piezoelectric actuators, which are orthogonally arranged, in a plane. The movable plane of each drive ball is same as the tangent plane between the hemisphere and each drive ball. The hemisphere on three drive balls is rotated in arbitrary direction by stick-slip motion of each drive ball. The rotational direction of the stage can be controlled by the movable directions of each drive ball. In this paper, the design and fabrication of the small hemispherical stage are described. The rotational directions of the stage are evaluated using a laser autocollimator.

57: "Experimental Activities on Step Motor Drives

Paolo Righettini, Roberto Strada, Alberto Oldani and Andrea Ginammi
Department of Design and Technologies University of Bergamo Italy

Thanks to their robustness, reliability and ease of use, step motor drives are widely used in several fields, mainly for small size automation. Step motor drives have also some well known bad running conditions related to their oscillatory behaviour and synchronism loss. In order to properly design the application, those conditions must be accurately taken into account setting-up proper mathematical models. In particular in this paper we refer to a simplified electro-mechanical model where the most of the parameters can be drawn from datasheets, while the others, as the equivalent damping factor, need experimental investigation. This paper deals with preliminary experimental activities performed on small size step motor drives for both testing the suitability of a test bench designed and developed in previous works, and outlining some remarks on the behaviour of the tested motors.

Session A3: Modelling 1

Chairman: H. Itoh, Tokyo Denki University

459""Integrative Conceptual Design of Products and Production Systems for Mechatronic Systems

Juergen Gausemeier1, Rinje Brandis1, Lydia Kaiser2

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[2]Fraunhofer Institute for Production Technology, Zukunftsmeile 1, 33102 Paderborn, Germany

Mechanical engineering considerably benefits from the increasing use of information technology. The arising new discipline is called mechatronics, which expresses the close integration of mechanics, electronics, control engineering, and soft-ware engineering. Hence, the design and production of such systems is an interdisciplinary and complex task, which requires effective and continuous cooperation and communication between developers from different domains during the whole development process. Within this context, a methodology for the integrative conceptual design of products and corresponding production systems has been developed in the collaborative research project VireS – "Virtual Synchronization of the Development of the Product and the Production System". The methodology is do-main-spanning and model-based and enables the analysis of the model in early design phases e.g. evaluating the costs and the robustness of the product and the associated production system.

587'"Application of Impulse Differential Inclusion for Uncertainty Analysis of Mechatronic Hybrid System

M.Zerelli, T.Soriano

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Dynamic systems are often modeled by differential equations. A good way to model uncertainty of components is to use differential inclusions. Parameters' variation may be small or large in depends on the nature of problem if it is tolerancing problem or sizing one. Our researches are based both on works of Raczynski on differential inclusion used as a simulation tool and Aubin who introduced impulse differential inclusion as a framework to model hybrid system. We have developed an algorithm to get different sets defined by Aubin. We proceed on an application of an impulse differential inclusion of a mechatronic system modeled by a hybrid automaton.

659'"Topological approach to solve 2D truss structure using MGS language

Mariem Miladi Chaabanea,[b], Régis Plateaux[b], Jean-Yves Choley[b] , Chafik Karraa, Alain Riviere[b], Mohamed Haddar[a]

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In this paper we are interested in introducing the notion of topological collection and transformation for the modeling of mechatronic systems by applying the MGS language (General Modeling System). This approach provides a generic local model that optimizes global behavior by separating the topology and the physics of the studied system. For this purpose, the MGS language is implied in the case of 2D truss structure. Since a good argument is observed, this approach can be generalized for modeling more complex systems (mechatronic systems).

672'"About metrics for integrated mechatronic system design

A. Warniez, O. Penas,T. Soriano

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After having underlined the increasing industrial constraints to make their design choices for new performing products, we examine existing decision aide-making process and their corresponding tools. We detail the complexity added to design integrated mechatronic system, to emphasize the need of a mean to measure the integration level of a mechatronic system to help designers to make their architecture choice. We focus our study about the use of metrics, as decision aide-making support for preliminary design of mechatronic integrated systems. So after having precised some terminology about the notion of metric, we present our approach to compare different architectures of a mechatronic system with the objectives of multi-domain and multi-level integration, which we applied to an integrated mechatronic system.

Session A4: Transportation 1
Chairman: K. Jo, University of Ulsan

78'''About the prediction of all-terrain vehicles rollover
X. Han, G. Mourioux, J.Stephant and D. Meizel
XLIM, UMR 7252 Université de Limoges/CNRS, ENSIL 16 rue Atlantis, 87000 Limoges, France

In this communication, a bibliographical review of existing criteria leading to evaluate the risk of rollover for wheeled vehicles is proposed. This gives a general overview of the problem of the attitude stability and the practical way to manage it. These criteria may be classified in two sets, the former being only concerned with static solutions and the latter including dynamic concepts. In both cases, the computation of the criterion needs values of variables that must be either directly measured or indirectly estimated by state observers based upon suitable models. This review results thus into lists of sensors and a priori knowledge necessary to evaluate the risk criterion. This analysis opens the way to algorithms aiming to evaluate and even forecast the risk of rollover.

375'''Model Predictive Control-based Drive Assist Control in Electric Vehicle -An Application to Inter Distance Control Considering Human Model
Yuji Okuyama, Toshiyuki Murakami
Department of System Design Engineering, Keio University, Yokohama, Japan.

Traffic accidents have become social trouble along with the increase in drivers and diversification. In traffic accidents the rear-end collision includes the risk of severe injury. About 30 percent of the cause of traffic accidents is the collision accidents. Therefore, this paper proposes two methods to control the vehicle. One is the safe and comfortable inter-vehicular distance control considering the cut-out and the cut-in with force sensory accelerator and brake pedal. This inter-vehicular distance control is used model predictive control-based three evaluation indexes. To prompt proper pedal operation, force sensory pedal motor generates pedal assist torque. The other is driver behavior model presented in quantification the driver's acknowledgment. To achieve this, evaluation index based on the visual acknowledgment information of drivers is used. Driving simulator experiment results are shown to verify the effect of the proposed method.

54; "Implementation of active Steering Systems into a Multibody Vehicle Model by Co-Simulation
Volker Dorsch
Faculty of Mechanical Engineering, Ostfalia - University of Applied Sciences Salzdahlumer Straße 46/48, 38302 Wolfenbüttel, Germany

Besides yaw rate control by braking intervention or torque vectoring, vehicle dynamics can also be stabilized by rear wheel steering. Alternatively the front wheel steering angle can be adjusted. This paper demonstrates the simulation process of combining a validated multibody vehicle model with a Matlab/SimulinkR controller model by co-simulation. The adjustments of the multibody model as well as the control algorithms of the active steering systems are described. Simulations of typical driving maneuvers show the improvements of vehicle handling by these systems.

Plenary session 14:30-15:30
Philippe LUBINEAU

CETIM Research and Development Manager, Mechatronics Convenor - ISO/TC 184/AH "Mechatronics"

V ° ¨¨International Standardization in Mechatronics

After general considerations on mechatronics and explanations about the industrial impact and benefits of standardization in this field, the presentation will describe the contain of this report and especially the different Standardization New Work Items which are proposed to be developed:
• Common understanding
• A consistent data model
• Applying system engineering
• A unique set of technical specifications
• Reliability/dependability

Afternoon 16:00-17:30

Session B1: NMA1
Chairman: K. Rotter, London South Bank University

694""Supporting research and education in mechatronics from a solution provider's point of view

Dirk Pensky
Festo Didactic GmbH & Co. KG, Rechbergstr. 3, 73770 Denkendorf

This presentation gives an overview about the experience Festo and in particular Festo Didactic gained by providing support and solutions for research and education in mechatronics during the past 20 years. Additionally, it gives a summary of existing and an outlook on upcoming networks in this area.

696'"-Establishment of Mechatronics Engineering Professional Groups in Jordan

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[1]German Jordanian University, P. O. Box 35247, Amman 11180, Jordan
[2]University of Applied Sciences, Goebenstr. 40, 66117 Saarbrücken, Germany

This paper describes the motivation and work performed to establish ways to link between academia and industry in Jordan, in the field of mechatronics engineering. Two efforts are described. First, the creation of an on-line forum, called the Jordan Mechatronics Network (JMN), for mechatronics professionals inside and outside of Jordan to share knowledge and facilitate cooperation, considering that many Jordanian engineers find employment in Arab Gulf states. This forum operates in the English language, is open, free, and user driven. This setup helps sustain JMN over time with minimal cost and overhead. The second effort is placed into the establishment of a society for mechatronics engineers in Jordan under the umbrella of the Jordan Engineers Association (JEA). The ongoing work currently finalizes the rules and regulations of the society, which is named Jordan Mechatronics Engineers Society (JMES). The JEA was established in 1958 and currently has over 81000 members. The JEA and JMES follow a traditional rigorous setup in the Arabic language with regulations for elections, membership, funding, investment, social and political activities, etc.

6: : "Exchanging Experience of Four Different Tempus Mechatronics Projects: Egypt-EU Partnership

Radwan H. Abdel Hamid,
HU, Cairo, Egypt

This paper explores and exchanges the experience gained from four different joint European projects directed mainly to the field of Mechatronics and funded by Tempus (Trans-European Mobility Program for University Studies) with about 3 millions €. These Mechatronics projects are based on consortium activities of EU-Egyptian and Jordanian partnership at different higher education levels including undergraduates and postgraduates programs. For successful outcomes of these projects the partnership also comprises other industrial and NGO's partners to reach practical higher educational Mechatronics programs complying with the real need for the industry and communities at the third party countries in Egypt and Jordan. In line with the objective of this paper, the author will demonstrate the typical features, difficulties, expected outcomes, replication, sustainability and the disseminations role in the four projects that are designed to benefit the Middle East partners and neighbor countries.

6; : "Role of the Centre for Education in Mechatronics – in networking Polish and Central European Academic Community

K. Kluszczyński, G. Kłapyta, D. Krawczyk
Silesian University of Technology, Faculty of Electrical Engineering, Department of Mechatronics
Gliwice, Poland

There are the main national and international fields of activities of the Centre for Education in Mechatronics CEM presented in the paper. There is also the short history of the establishment of the Centre for Education in Mechatronics presented.

Session B2: Robotics 1

Chairman: R. Sell, Tallinn University of Technology

344" Fault tolerant gripper in robotics

R. Noureddine[1], F. Noureddine[2], A. Benamar[3],
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The work presented in this article shows, through a case study, the different stages of designing a fault tolerant system; a system which can tolerate faults without losing its operational capability. This system includes a gripper mounted on the wrist of a robot manipulator. First the faults were identified, then the residual generation stage was designed. Analyzing this residual allows us to show that artificially injected faults can be detected and an alarm is generated for an emergency stop command. With regards to the gripper, we have only dealt with the faults we were able to solve thanks to the accommodation stage which must control both hardware and software reconfigurations. The considered faults originated in the electronic interfaces and for an efficient supervision we have designed the whole gripper control. The electronic interfaces concerned by fault occurrence are duplicated to ensure robot task continuity.

383 Structural Design and Dynamic Analysis of Robotic Fish with Piezoelectric Fiber Composite

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Development of Mechanical Engineering and Intelligent Systems, The University of Electro-Communications,1-5-1
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Robotic fishes using artificial muscle as actuators have been described recently. The purpose of this work is to develop a flexible robotic fish using the piezoelectric fiber composite (PFC). To achieve the good flexibility and mobility of the robotic fish, we proposed a simple and compact structure. The load simulation method of piezoelectric actuator was employed to improve the fish's movement performance and swimming efficiency. By the analysis of the driving characteristics of the PFC, the robot structure with symmetrical distribution was designed based on the caudal fin propulsion mode. This structure was verified reasonable in the theoretical and simulation method. The dynamic characteristics of this underwater robot were both analyzed through the experiments and numerical analysis of Finite Element Method (FEM). The calculated results were congruent well with the experiment measurements of the prototype. Relatively high swimming speed was achieved during the experimental tests for a prototype. This indicated the numerical methods can be applied in the structural optimization and dynamic analysis of the robotic fish. More information will be available for the fluid-structure interaction analysis in future.

447" Study of Desktop Type External Shoulder Prosthesis Control with Bilateral Servo System

T. Higashihara[1] Y. Saito[2] K. Ohnishi[3] T. Ohshima[4] T. Komeda[5]
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[4] Toyama Prefectural University, 5180,Kurokawa,Toyama, Japan, 739-0398
[5] Shibaura Institute of Technology, 307, Fukasaku, Minuma-ku, Saitama-shi, Japan, 337-8570

Recent developments in shoulder powered prosthesis control can be divided into two types. The first type, as seen in development at Northwestern University, is depended on a myo-electrical signal replacement surgery in the chest area to allow the control of shoulder rotation, elevation, arm flexion and extension and the opening closing of the hand. On the other hand, our research focuses on using a microcomputer to control pre-developed patterns of the different motions. From our experience in position control of the shoulder prosthesis, this project proposes the need for force control in each of the joints set on the desk. A major concern of the shoulder prosthesis is the need of simultaneously control on its with the consideration of external loads. The external loads on the prosthesis post-installment are significant enough that the position control heavily depends on these external loads. This project proposes our bilateral servo system as a solution for near future desktop type shoulder prosthesis to provide the necessary position and force controlled by myoelectrical command.

655" Control of Musculoskeletal Arm using a Visual Space

Kento Hashimoto, Satoshi Komada, Daisuke Yashiro and Junji Hirai
Department of Electrical and Electronic Engineering Mie University ,Tsu , Japan

Robots in human living areas need to recognize their changing environment, be safe for humans, and versatile to do various tasks. For this purpose, we propose in this paper an application of Linear-Visual-Servo (LVS) on a musculoskeletal arm. In

LVS, displacement transformation is expressed as a constant matrix and converts from work space to joint space is used. On the other hand, for the control of the musculoskeletal arm, force transformation which converts joint space to muscle space is used thanks to the redundancy caused by a greater degree of freedom in muscles than in joints. In order to use the redundancy of musculoskeletal arms, the transformation from work space to joint space is changed from displacement transformation into force transformation.

Session B3: Simulation 1

Chairman: M. Haddar, ENI Sfax

28" Analysis and partitioning of heterogeneous models of hybrid power trains with regard to real-time simulation

S. Chaker, B. Bäker

Institute for Automotive Technologies Dresden – IAD, Department of Automobile Mechatronics, Dresden University of Technology, Germany

In this paper, an approach for the efficient handling of mathematically stiff models in the case of a real-time simulation is shown. Here, the dynamic characteristics of models created in the simulation environment "Dymola" are analysed and the sources of the model stiffness are identified. Based on the gained information and according to the constraints of the real-time simulation, the model is adjusted automatically. In a first step, based on the eigenvalue distribution in the region of stability the model is partitioned into several sub-models. Each of these submodels is homogeneous and not stiff. If one or more models violate the real-time constraints and still threaten the stability of the simulation, an automatic optimisation of the model parameters will be performed in a second step. This affects the model's time constants and therefore the dynamic behaviour of the system. Based on this methodology stiff models are automatically adjusted and optimised in terms of real-time simulation. Thus, long analysis phases and the high number of iterations to identify and to eliminate the model stiffness can be reduced. Therefore, the transition from modelling (MIL) to real-time simulation (HIL, SIL) becomes more efficient.

364" Haptic Paddle and Fuzzy Based Virtual Environment Model Control System as a Didactic Tool

Senka Krivić, Admir Kaknjo, Muhidin Hujdur, Nadir Zubović, Emir Sokić

Faculty of Electrical Engineering, Department of Automatic Control and Electronics, Sarajevo, Bosnia and Herzegovina

The paper deals with design, construction and implementation of bilateral control system using fuzzy regulation. The aim of paper is implementation of a system which can be used as a didactic tool for better understanding of bilateral control concepts, as well as a base for further work. The system is composed of mechanical model of haptic paddle with one degree of freedom and virtual model of haptic paddle and its environment, interconnected using acquisition card. Virtual environments control is created using fuzzy logic. After implementing control algorithm and connecting two models – the mechanical and virtual, the functionality of system was confirmed by experimental data.

399''' Rapid-Control-Prototyping of Industrial Drives for the sercos Automation Bus

Prof. Dr.-Ing. Elmar Engels[1], Dr.-Ing. Holger Schnabel[2]

[1]University of Applied Science, Aachen, Germany
[2]Bosch Rexroth AG Lohr am Main, Germany

This article describes the functionality of a MATLAB1 library that can be used to develop motion-logic applications in MATLAB programming language for industrial drive and control systems using the well known sercos automation bus. Therewith MATLAB's functionality is extended to designing automation applications from single axis machines up to multikinematic robots.

647''' Modeling and Design of an Active Suspension System with Maple and MapleSim

[1]N. Gachadoit, [2]R. Renaud,
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[2]Supmeca, 3 rue Fernand Hainaut, 93400 Saint-Ouen

In this contribution we present new type of modelling tool taking full advantage of symbolic computing. Physical components are described from block libraries and a fast developing physical language. Directly from the block diagram description the analytical equations of the system are automatically generated and simplified with a powerful symbolic engine. On different kind of suspension systems with increasing complexity, we show how the system is described and how easy it is to get access to the equations. Automatic generation of equations is used in a math tool to analyze the systems and carry out control design steps. Besides traditional analysis based on numerical computing, several symbolic techniques are used.

Session B4: Medical Applications 1

Chairman: K. Ohnishi, Tokyo Denki University

3; ; "Variable compliance device for a respiratory physiotherapy training simulator

Tobias Büssing, Laurent Goujon, Christine Barthod
SYstems and Materials for MEchatronics Laboratory (SYMME), University of Savoie, BP80439, 74944 Annecy-le-Vieux, France

Semi active devices to modify the stiffness or the damping of systems received significant attention in the recent years. In this paper, two solutions of a variable compliance device to change the physiotherapists feeling of the thorax compliance of a 6-month old infant torso training simulator are presented. A first solution, using a variable orifice device which allows to change the compliance by changing the radius of a flow pipe is proposed. Another solution is to use a magnetorheological fluid damper. Both systems are presented in detail and discussed especially for their applicability to be integrated in the simulator.

4: 2 Quantitative Spectroscopic Tomography for the Non-invasive Measurement of the Biogenic-substances

Wei Qi[a], Daisuke Kojima[a], Shun Sato[a], Satoru Suzuki[a], Pradeep K.W. Abeygunawardhana[a],
Akira Nishiyama[b] and Ichirou Ishimaru[a]
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[b]Faculty of Medicine, Kagawa University, 1750-1 Miki-cho, Kita, Kagawa-pref., 761-0793, Japan

The non-invasive blood sugar sensor by using imaging-type 2-dimensional Fourier spectroscopy is to be realized in this work. The spectroscopic imaging, that observes the biological tissue by the dark-field image, can measure the biogenic substance quantitatively such as the glucose concentration. For the quantitative analysis with high accuracy, the correction of the background such as the light-source fluctuation and the phase-shift uncertainty is inevitable issue. Thus, the quantitative band-pass plate on which the grating is locally formed has been proposed in this paper. Here, the diffractive light, whose diffraction angle depends on the wavelength, has been used as the reference light. Object lens is used to narrow down the reference light and narrowed band pass diffraction light is obtained. The changes of imaging intensities with interference phenomenon on whole area of the observation image can be confirmed using the quantitative band pass filter. Thus, the light-source fluctuation from the amplitude of the reference light intensity and the phase-shift uncertainly from the interference-phase can be corrected respectively. In this paper, the theoretical accuracy of Fourier spectroscopy calculated with the numerical simulation and the background correction method of the spectral-absorption-index image by the diffraction grating type quantitative bandpass plate are presented.

5; 3"Development of a Patient Simulator for Physical Therapy Exercise of the Upper Limb

Yoshiyuki Takahashi[1], Takashi Komeda[2], Hiroyuki Koyama[2], Shin-Ichiro Yamamoto[2], Takayuki Arimatsu[2], Yukio Kawakami[2], Kaoru Inoue[3], Yuko Ito[3]
[1]Toyo University, Saitama, Japan
[2]Shibaura Institute of Technology, Saitama, Japan
[3]Tokyo Metropolitan University Tokyo, Japan

Physical therapists play an important role to help people to regain social life after a disease or physical handicap. However, they can obtain their skills only from their practical experiences. The physical therapist trainee can enrich is experience only from the clinical practical training and this opportunity is limited. Therefore, we have been developing the upper limb patient simulator, which reproduce the stiffness of the elbow joint to allow trainees to increase the opportunities to obtain the practical exercise of the physical therapy. The system reproduces the diseases by generating stiffness of the elbow joint when the trainee tries to flex the simulated patient's arm elbow joint. We developed a mechanical part and a control system to realize the patient conditions and the full system has been evaluated by veteran physical therapists.

Thursday November 22

Coffea
Marija JANKOVIC (Ecole Centrale Paris) **Architecture generation and evaluation** *D000 - 9h00 - 10h00*

Coffee Break
Parallel sessions *10h30 - 12h00*

Session C1 *D100* NMA 2	Session C2 *D101* Actuators & sensors 2	Session C3 *D102* Supervision 1	Session C4 *D103* Transportation 2

LUNCH
Laurent ZIMMER (Dassault Aviation) and Pierre-Alain YVARS (SUPMECA Paris) **The design of complex engineered systems: Recent trends and expected breakthroughs** *D000 - 13h30 - 14h30*

Coffea Break
Parallel sessions *15h00 - 16h30*

Session D1 *D100* Education 2	Session D2 *D101* Vision systems	Session D3 *D102* Modelling 2	Session D4 *D103* Medical applications 2

GALA Dinner (Seine)

Plenary session 9:00-10:00

Marija JANKOVIC

Laboratoire de Génie Industriel, Ecole Centrale Paris

V ° ⸽⸽**Architecture generation and evaluation: Integrating multi-domain knowledge for global system performance evaluation**

Multi-domain system design and optimization gain on importance in order to be able to predict system performances as early as possible in the system design. Several approaches exist; and architecture design is one of the scientific fields addressing these issues. Architecture generation and evaluation are critical points in complex system design. We present two complementary approaches. The first approach is based upon well know Design Structure Matrix approach. The main objective of this work is to capture an defined structural system interfaces. This data is afterwards used to generate all possible system architecture and to identify risks that are specifically linked to design parameters shared across interfaces. Moreover, several design scorecards are proposed to support design project decision making in order to identify global trade-offs and performance conflicts on the system level. This work is also deployed in industry and tested on a real case industry project.

Uncertainties concerning component characteristics and their impact onto overall systems performances are often not taken into account in early design stages. In this second approach, we propose a Bayesian Network approach for system architecture generation and evaluation…

Morning 10:30-12:00

Session C1: NMA2

Chairman: M. Löffler-Mang, University of Applied Sciences Saarbrücken

699''' An International Network on Development and Implementation of a MSc Program in Mechatronics for Egypt and Jordan

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A consortium of European and Middle East institutions maintain a vital network for establishment of theengineering discipline of Mechatronics. The cooperation started in 2007. Funded by TEMPUS a project established a first Mechatronics program at three Egyptian Universities. About 800 students had enrolled in the new BSc program at the end of the project DIMPTOT [1] in 2010. Extended to the needs of the regional partners in Egypt and Jordan, a new project was started in 2011. The goal of the new project is the establishment of a MSc
program in Mechatronics in combination with a lifelong learning strategy. Named JIM2L, Development of a Joint International Master Degree and Lifelong Learning Framework in Mechatronics, the project is funded by the EACEA under TEMPUS IV, Joined Projects. This contribution describes the motivation, the goals, objectives and network partners and first outcomes of the project.

6: 6'' University –Industry Networking For Training, Research, and Employment - HTI Experience.

Y.H. Hossamel-deen* & M.A. Sadek **
* Professor, HTI representative in JIM2L
**Professor, HTI Head of Board of Administration- Dean

In 1988, The Higher Technological Institute (HTI) was established in the new industrial city called "The Tenth of Ramadan City". HTI is the first private university level Institute for Engineering Education in Egypt. One of its main missions is to build a strong and sustainable link with industry especially in the local community. From day one, the main elements of this link were clear and accordingly efforts have been spent to build and strengthen such elements in the following main directions: development of industry linked educational, programs, students' internships and employment, specialized courses for engineers and technicians in industry, problem solving for industry, research & development.

N1C'' The Mechatronics Forum in the UK

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The Mechatronics Forum in the UK is an interest group sponsored by and part of the Institution of Mechanical Engineers, London. Founded in 1990 this forum has enabled professional engineers from Industry and Academia to share innovative ideas in this field. The group has run biennial mechatronics conferences since 1990, as well as hosting the 2009 REM conference in Glasgow, Scotland. Industrial visits, news magazines, and annual guest lectures in London IMechE HQ have also featured in their activities.

6; 6''' Faculty for Factory Program: A University-Industry Link in Jordan

Yousef Al Abdallat* and Tarek A. Tutunji**
*Industrial Engineering Department, University of Jordan, Jordan
**Mechatronics Engineering Department, Philadelphia University, Jordan

Faculty for Factory (FFF) program is a national Jordanian program that was started in 2003 with the purpose of strengthening applied scientific research cooperation between the universities and the industry. A significant result of the program was the development of a dynamic network composed of industrialists and university professors. In this paper, the FFF methodology and its role in helping bridge the gap between the industry and the universities will be presented. An emphasis on mechatronics-related projects will be highlighted. Also, the experience gained from participating in the program as a researcher and as a reviewer will be discussed and SWOT analysis will be provided.

724'' Using the Social Networks on the Internet to Establish Mechatronics Network

Mohammed S. Sayed[1], Nabil H. Mostafa[2]
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Social network websites became part of our daily internet use. Nowadays every organization has pages on social networks such as Facebook and Twitter. They use their pages to communicate with costumers and users. Social networks can also be used to establish professional networks or associations. Mechatronics is a multidiscipline engineering program that represents combination of Mechanical engineering, Electronic engineering, Computer engineering, Software engineering, Control engineering, and Systems Design engineering. Mechatronics education programs started in Egypt a few years ago. In this paper, we present how Social Networks on the internet, especially Facebook, was used to establish an Egyptian Mechatronics Network that can represent the first step to form an Egyptian Mechatronics Association.

Session C2: Actuators & Sensors 2
Chairman: S. Yukio, Shibaura Institute of Technology

32; " Development of Visual Information Function in Reaction Force Feedback Type Gait Training System

H. Ikeuchi[1] Y. Saito[2] K. Ohnishi[3]
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Our developing Gait Training System is the training device that tries to obtain the effect similar to the walk training in the warm water swimming pool. A train patient is slung and supported by the slinging system. They walk the force plate top. Slinging it up power is controlled on the basis of the information from the force plates. In this paper, we show the outline of our system and improvement of sling mechanism using bilateral servo system. Next, method and application of force measurement is shown and development of visual feedback function of trainee's foot contacted point and target contact point is shown.

433" Industry Applications of Small Induction Heater

Hideo Tomita
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Small induction heating technology is recent trending for home appliances and industry applications. This paper deals with advanced applications of small induction heater, as the examples of bonding methods in house/building constructions and superheated steam generator.

546 Vector Based Speed Control of Permanent Magnet AC Servomotor with FEA and Experimental Verification

E. Yolacan and M. Aydin
Department of Mechatronics Engineering, Kocaeli University, 41380, Izmit, Turkey

In this paper, real time vector control implementation for an AC servomotor is presented. Matlab-Simulink and dSpace control board were used. Speed control on desired reference using vector control technique is accomplished in the paper. Experimental results are provided for different speed conditions.

625" Comparison of Different Mathematical Models of An Electromechanical Actuator

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In the paper a brief comparison between different models of electromechanical actuator is presented. Main part of the paper is focused on model using Hamiltonian equations which employs flux linkages as state variables in the state space equations. Topological approach is used in the model implementation. This model is compared with one described by Lagrange formalism, which is much more popular in the literature. In both models eddy currents and hysteresis phenomenon are neglected to enable application of state space description. A 3-phase we connected stator winding without a neutral wire is considered in detail as the most important connection schema in practical applications.

Session C3: Modelling 2

Chairman: R. Brandis, Heinz Nixdorf Institute / University of Paderborn

42"A Model Transformation Process to Realize Controllers of Ship Autopilot Systems by the Specialized MDA's Features with UML/SysML

N. V. Hien[1], T. Soriano[2]
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[2] SUPMECA - Institut Supérieur de Mécanique, Place G. Pompidou, Quartier Mayol, 83000 Toulon, FRANCE

This paper shows out an executable object-oriented process which is based on the Model-Driven Architecture (MDA) to effectively realize ship autopilot systems' controllers as an integrated mechatronic system. It brings out step-by-step main activities to cover completely the requirement analysis, design and deployment phases of these systems. In this process, we adapt the ship dynamic model-to-be used and MDA's features such as the Computation Independent Model (CIM) with use-cases and hybrid automata, the Platform Independent Model (PIM) carried out by using the Real-Time Unified Modeling Language (RT UML) or System Modeling Language (SysML), and its Platform Specific Model (PSM) implemented by functional blocks to perform entirely the development lifecycle of ship autopilot system controller. The model transformation rules are also brought out and applied to convert the identified PIM into PSM for implementing quickly this control system with different industrial frameworks. Then, its deployment model had been tested on a model ship with the predetermined course and control performance. This process also allows the determined design elements to be customizable and reusable in new control applications for different types of ships.

6: "Development of Mechanism Construction CAD Tool and the Motion Animation

Hiroshi Itoh
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We have been created several kinds of mechanism construction system for over fifteen years. The first one applied 2D graphics to show mechanical element on the screen and we aimed at the combination of elements. After reviewing of these four systems, we present newly developed Mechanism Construction Tool. In the system models are created by assigning parameters for the primitives and they are located on the 3D space, combined with the other models. The accomplished mechanism structure is shown in the graphic screen by moving them in real time and the structure data are transmitted to the OmegaSpace VR environment development tool through Internet communication. In this paper, we describe the objectives of the CAD by explaining its feature, basic structure, functions and application examples and the expansions for the future development.

323 Solution Patterns of Software Engineering for the System Design of Advanced Mechatronic Systems

Harald Anacker[1], Jürgen Gausemeier[1], Roman Dumitrescu[2], Stefan Dziwok[3], Wilhelm Schäfer[3],
[1]Heinz Nixdorf Institute, University of Paderborn, Fürstenallee 11, 33102, Paderborn, Germany
[2]Fraunhofer Institute for Production Technology IPT, Project Group Mechatronic Systems Design Zukunftsmeile 1, 33102 Paderborn, Germany
[3]Heinz Nixdorf Institute, University of Paderborn, Zukunftsmeile 1, 33102 Paderborn, Germany

Recently, mechatronics as a self-contained discipline has doubtlessly shaped the development of technical systems. Mechatronics means the close interaction of mechanics, electronics, control engineering and software engineering in order to achieve a better systems behavior. Due to the advancement of information and communication technologies, the functionality of mechatronic systems will go far beyond current standards along with the potential to increase their robustness, flexibility and reliability. The design of such advanced mechatronic systems is a challenge. The increasing complexity requires a consistent comprehension of the tasks between all the developers involved. Especially during the early design phases (conceptual design/ system design), the communication and cooperation between the mechanical, electrical, control and software engineers is necessary to design a first overall system model. In this context, the main difficulty is how to integrate into a system model the solutions that have already been successfully used and described in detail. Currently, the reuse is partially established during discipline-specific engineering – in areas such as mechanics and software engineering. Nevertheless, a catalogue of domain- spanning reusable abstracts that may describe solution patterns for holistic system designs does not exist. Hence, to create a collective solution space as wide as possible, it is necessary to abstract gradually the discipline-specific described solutions on a generic level. The precondition is a functional description. It is easy to see that a function has to depict the solution in a neutral and abstract way as well as the volitional relation between the input and the output of a system. In our work, we present the necessary abstraction of domain specific solutions exemplified by reusable and detailed described solutions of software engineering.

62; "A new Multi-criteria Indicator for Mechatronic System Performance Evaluation in Preliminary Design Level

Moncef Hammadi[1], Jean-Yves Choley[1], Olivia Penas[1] and Alain Rivière[1], Jamel Louati[2] and Mohamed Haddar[2]
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[2]U2MP, ENIS, University of Sfax, Route de Soukra Km 3.5 B.P.1173, 3038 Sfax, Tunisia

Optimizing a multidisciplinary integrated system design, taking into account multi-criteria interacting requirements, is a real challenge in mechatronic design. A new multicriteria indicator for mechatronic system performance evaluation is formulated and described in this paper. An example of mechatronic system design is considered to validate the presented approach. It will be shown that the new indicator helps designers to evaluate and therefore optimize a mechatronic system design efficiently and rapidly.

Session C4: Transportation 2

Chairman: M. Oberhauser, University of Applied Sciences Esslingen

467'" Localization and Tracking of Same Color Vehicle under Occlusion Problem

Ming Qing, Van-Dung Hoang, and Kang-Hyun Jo
University of Ulsan, Ulsan, Korea

This paper proposes a vision based multiple vehicle detection and tracking system. Vehicle tail light information is used to localize vehicle potential region, then each candidate is verified by a back propagation neural network (BPNN) trained by Gabor feature set. In the multiple vehicle tracking stage, multiple scale vehicle tracking, same color vehicle occlusion and observation model updating problem are investigated. Mean shift algorithm is main part of tracking sub-system; each detected vehicles are tracked by a mean shift tracker in parallel. Vehicle tail light pairs which are determined in vehicle detection step are used to adjust tracking windows size. Color information is observation model in tracking algorithm, which is insensitive to different color vehicle occlusion problem; meanwhile, only color information based tracking algorithm can't deal with same color vehicle occlusion case. To overcome this problem, local edge image projection technique is implemented. In experiments, the result shows the proposed system have good performance in multiple vehicle detection and tracking system in the daytime, the results shows 84% accuracy detection rate, 5254 frames image sequences are texted for multiple vehicle tracking.

486" Lane Tracking and Obstacle Avoidance for Autonomous Ground Vehicles

T. S. Abd Al-Zaher[1], A. M. Bayoumy[1], A. M. Sharaf[1], Y. H. Hossam El-din[2]
[1]Military Technical College, Kobry Al-Koba, Cairo, Egypt
[2]Higher Technological Institute (HTI), Tenth of Ramadan City, Egypt

This paper presents a comprehensive experimental and theoretical study of a proposed mechatronics system for an Autonomous Ground Vehicle (AGV). This vehicle has the capability of: lane detection, tracking and obstacle avoidance. The system considered employs a computer vision technique in which real time data are collected by a single calibrated camera. Further processing and analysis to the images captured by the camera are carried out to recognize the lane lines and the obstacle dimensions. A PID controller is implemented to predict and control the vehicle heading angle in order to properly follow the lane and/or avoid obstacles. The numerical simulation is implemented in the MATLAB/Simulink environment. This choice has added the possibilities of the inclusion of advanced control strategies and the use of the real-time and image processing toolboxes. For the purpose of analysis and examination, a realization model car has been equipped with the proposed mechatronics system and used to carry out several field tests. The outcomes from both the field experiments and the computer simulation show a good agreement with each other which reveals the applicability of the proposed system.

593" Analysis of Active Toe-in for Vehicle Longitudinal Dynamics

Robert Buchta, Xiaobo Liu-Henke
Ostfalia - University of Applied Sciences, Faculty of Mechanical Engineering, Institute for Mechatronics (IMEC), Salzdahlumer Str. 46/48, Germany, 38302 Wolfenbüttel

A wheel-individual steering system allows influencing the toe-in actively. This possibility can be used to interfere with the longitudinal dynamics of a vehicle. Thus a potential for a functional integration of braking and steering arises, which has to be analyzed. In this paper, an active toe-in for generating braking forces is examined with the help of simulation and the potential is discussed. It also shows an approach how the lateral behavior of vehicle tires can be determined experimentally with measurements of the vehicle longitudinal dynamics. A verification of this approach is done with a testbed of the Mechatronic-Mobile (M-Mobile).

Plenary session 13:30-14:30

Laurent ZIMMER[1] and Pierre-Alain YVARS[2]

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Ⅴ ˚¨The design of complex engineered systems: Recent trends and expected breakthroughs

This plenary session recalls the current practices in the design of complex engineered systems and gives an overview of the most recent trends. The advantages of these approaches are highlighted and proposals are made to overcome their current limitations. Finally we propose some tools and methods that should transform the promised improvements into effective breakthroughs in the design process.

Afternoon 15:00-16:30

Session D1: Education 2

Chairman: D. Meizel, XLIM

3; 6" Lab Description Language - A framework approach for describing and mediating remote and virtual labs

S. Seiler[1], R. Sell[2], D. Ptasik[3]
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[1]Tallinn University of Technology, Ehitajate tee 5, Tallinn, Estonia

More and more universities and schools across the world are developing different types of remote labs for their own operations. However, there is very little evidence at the present time that such local labs are used by or shared with other institutions in order to provide educational support for a wider range of students on a regular basis. Several other virtual and remote laboratories have been developed for a variety of disciplines. But these diverse proprietary interfaces, software components and implementations for each experiment are a problem for learners and teachers (no common user interfaces and APIs are used). Therefore, it is hard to integrate new remote labs or create virtual labs for non-engineers. Due to incompatible software implementations it is also a challenging task to integrate external labs into an existing lab platform. That complicates the sharing of labs between different organisations and universities. With the approach of "Lab Description Language" (LDL) authors of this paper are introducing a new framework concept for describing and mediating remote and virtual labs. This concept is demonstrated using the example of the Virtual Micro Controller Unit (VMCU) developed by paper authors.

453 Project-oriented approach in mechatronic education in Macedonia, Kosovo and Montenegro

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[2]Faculty of mechanical engineering and mechatronics, Aachen University of Applied Sciences, Goethestraße 1,52064 Aachen, Germany

The industrial developments in the last two decades and the industry requirement for practical knowledge have made it necessary to reconsider the classical engineering curriculum in the universities in the Western Balkan Countries. A multidisciplinary approach with focus on project oriented education was introduced to fulfill the requirements of modern technological society and industry. Based on the industry demands and EU best practices, a project-oriented approach in

mechatronic education was introduced in 4 Western Balkan Universities in the frame of a Tempus project. Two different approaches for introducing student projects as part of project oriented education are presented. The first one is the project oriented module Pro8, designed to simulate the future working environment of mechanical and mechatronics engineers. The second one are Mechatronic Design Studios established in 4 WBC Universities with the main objective of supporting project oriented education.

667 Development Projects as an Integral Element in the Education of Mechatronical Engineers

R. Dudziak, J. Henrich, D. Mohr

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In the education of mechatronic engineers several didactic elements are used to give these engineers a good basis for their professional life. In addition to the standard learning situations such as lectures, exercises, lab experiments, tutorials, seminars, e-Learning, placement semesters (also abroad) or internships and finally the bachelor thesis with a colloquium, we have introduced development projects. The paper presents the didactical approach for development projects, the realized Mechatronical projects and the teaching results by integrating all different learning situations in such a development project.

67: " "Deux écoles qui collent à l'industrie", 15 years of French Mechatronic Engineering between SupMéca Paris/Toulon and University of Applied Sciences

M. Oberhauser*, Th. Soriano**

* University of Applied Sciences UAS 73000 Esslingen, Germany
** LISMMA SUPMECA Maison des technologies, 83000 Toulon, France

The paper describes the collaboration between French Engineer school Supmeca and German University of Applied Sciences Esslingen to form engineers in the domain of mechatronics especially embedded in automotive systems. Both academic systems are explained and an example of teaching collaboration is presented in the field of powertrain.

Session D2: Vision Systems

Chairman: R. Biesenbach, Hochschule Bochum

01 Distributed Image processing scheduling in Heterogeneous computing network systems

*Farzad Norouzi fard, Ali Broumandnia, Sasan Mohammadi

A decretive concern in distributed computing systems is to efficiently schedule the tasks among all processors so that the overall processing time of the submitted tasks is at a minimum. In this article, following the recently evolved paradigm, referred to as divisible load theory (DLT), we conducted an experimental study on the time performance to process a large volume of image data on a network of workstations. We present our program model and timing mechanism for the distributed image processing and finally display effects of δ parameter and test cases in our mentioned algorithm.

86" Robust Surface Reconstruction in SEM with Two BSE Detectors

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[2]Yokohama Research Laboratory, Hitachi, Ltd., Yokohama, Japan 244-0817

This paper proposed a robust 3D surface reconstruction method which could automatically eliminate shadowing errors. For modeling shadowing effect, a new shadowing compensation model is introduced based on angle distribution of backscattered electrons and further modified with some practical factors. Furthermore, the presented iterative shadowing compensation, which performs commutatively between compensation of image intensities and modification of 3D surface, can effectively provide both the accuracy 3D surface and the compensated images after convergence.

4; 4" Improvement of Recognition Rate of Towel Mark Recognition System

Tatsuya Hojoh[1], Seiji Hata[1], Junichiro Hayashi[1], Toshihiro Hamada[2], Hirotaka Hojoh[3]
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Flexible objects such as clothes are hard to be handled by robots. But the working conditions for laundry factories are severe because of dusts, heats and steams, and full automation systems which can handle clothes are highly required. To automate these factories, a cloth handling robot system has been developed. It can handle face towels and hand towels, successfully. But to handle various kinds of towels, it is required to recognize the marks on them. The marks on towels are weaved in cloth and it requires the special lightings. The image of the towel marks contains many texture noises, and it is generally hard to recognize the mark in many textures. Here, to recognize the marks, the inclined lighting system and the recognition method using HOG features have been introduced. Evaluating the HOG feature space distances makes robust recognition of marks on cloth textures. The system have embedded to the cloth handling system and proved its efficiency. But the system still has a little failures of recognition. To meet with the failures, here, the cause of the failure has been analysed, and the system has been improved by developing 3D wrinkles detection method.

686 Human Motion Tracking and Feature Extraction for Cognitive Rehabilitation in Informationally Structured Space

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This paper discusses measurement methods of human motions based on 3D distance image sensor, and human interaction of rehabilitation using robot partners. We focus on rehabilitation programs for Unilateral Spatial Neglect. First, we explain robot partners and sensor networks for rehabilitation support. Next, we apply a method of extracting human motions from 3D distance image by using growing neural gas based on distance criteria. Furthermore, we propose a human motion analysis method based on evolution strategy and neural network. Finally, we discuss the effectiveness of the proposed methods through several experimental results.

Session D3: Supervision 1
Chairman: J. Jäkel, HTWK Leipzig

54" Wireless Sensor Network for monitoring, diagnosis and supervision

NASSER Habib[1,2], Nacer K. M'Sirdi[1] and NAAMANE Aziz[1]
1LSIS UMR 7296: Information Sciences and System Laboratory, SASV Project, Marseille 13397, France.
2Mechatronic engineering ENISo, Tunisia, Email: habib.nasser@lsis.org

In this paper, we present a Wireless Sensor Network (WSN) application to avoid obstacles and vehicle accidents.
The system is composed of a sensors set, a managing unit, a wireless communication card and a monitoring platform. A microcontroller board collects data from sensors. The collected data are transmitted wirelessly to the monitoring unit for data storage, processing and adjusting. The main goal is to integrate robust observers and decision to build a fully autonomous vehicle, build intelligent driver assistances and embedded diagnosis system. First, we present a three WSN technologies which provide an efficient solution for our needs. Then we develop an android and Macintosh smart applications for monitoring and supervision. Further the realization and implementing of wireless sensor network technology are also detailed. Finally we test an obstacle avoidance algorithm for mobile robot, we plot data acquisition results and we propose a control law for the robot.

3: 4" Study for a defect detection system with capacitance on the printed wiring board

Masanori NOGUCHI†, Yukio SAITO, Okitoshi TSUNODA, Hideo TOMITA
Graduate School of Tokyo Denki University, Faculty of Science and Engineering
Ishizaka Hatoyama, Saitama, 350-0394, Japan

Recently consumer products focused on electrical devices are miniaturized and its packaging size becomes smaller and smaller such as cellular phones, digital cameras and etc. It means that an innovation to miniaturize the printed circuit board (PCB) is required. Along with this requirement of the minute PCB, a technique of the fine pattern design and tiny component mounting on the board must be newly developed. Regarding a growing trend of the minute and multi-layers design of the PCB, a line width of the circuit pattern is reduced up to 25 μm and then the defect inspection is proposed as the most important technology. Therefore we study a new system development for the defects which are difficult to inspect on the fine patterns. To find the defects, a continuity test is implemented by a non-contact method and the inspection for finding the position of the defect is request. In this report, as the way of the continuity test by using the probe, we have an experiment of the contacting method. Moreover, we can compare it with the non-contact method on the board.

599 "A Study on Power Supply Reliability of Microgrid with Renewable Energy Considering Dynamic Behavior

Takao Tsuji

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It is of prime importance to introduce a large amount of distributed generators (DGs) in order to realize the sustainable energy society. In distribution systems with many DGs, it becomes important issue to maintain the power supply reliability. It is considered that power supply reliability can be improved in microgrid because it can continue the power supply even in the case of outage in utility grid. In order to clarify the effectiveness for the reliability, the authors have developed so far a new algorithm to modify the protective relay action and power system operation when a fault occurs. However, only the adequacy is treated in those papers. Actually, not only adequacy but also security must be satisfied in order to realize the transition to the islanding operation mode. Hence, in this paper, we develop a new method which can derive "Islanding Security Region (ISR)" representing the set of required conditions to realize the transition successfully. By using the ISR and reliability analysis method, power supply reliability considering dynamics of microgrid can be calculated.

Session D4: Medical Applications 2
Chairman: J. Lottin, Polytech Annecy-Chambéry

43; "Noise suffered by the Autistic: Can Mechatronics Help?

K.R.G. Rotter, F. Jensen, M.A. Atherton
Brunel University, Uxbridge, UB8 3PH, UK

People with autism often find common noises distressing. Avoiding these noises severely restricts their lives. Noise cancellation technology may be able to selectively attenuate the sounds that bother them, and this paper considers potential elements of the nuisance noises. The aim is to open the way to a mechatronic intervention that will greatly enhance quality of life for those with autism by reducing these noises whilst still enabling full communication. The potential design, prototype, and tests for its suitability in a range of day-to-day settings are considered.

529"Wheelchair Seating Evaluation System ~ Introduction of System Functions ~

A. Hanafusa[1], K. Ouki[1], K. Miyazaki[1], T. Komeda[1], T. Ikeda[2], N. Suzuki[3], A. Hattori[3]
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[2]Polytechnic University, Department of Mechanical System Engineering, 4-1-1 Hashimotodai, Midori-ku, Sagamihara, Kanagawa 232-5196, Japan
[3]Institute for High Dimensional Medical Imaging, Jikei University School of Medicine, 4-11-1 Izumihoncho, Komae, Tokyo 201-8601, Japan

In this study, a system for evaluating the wheelchair seating posture is introduced. The system consists of three subsystems: a seating posture changing system, a seating posture analysis system, and a propulsion analysis system. The seating posture changing system uses pneumatically controlled airbags installed in the wheelchair seat to change the posture of the patient and aims to generate a good posture heuristically. The seating posture analysis system uses seat sensors, video cameras, and whose analysis software to measure and analyze the current posture by seat sensors. One of the features of the analysis system is that the shape of the spine is estimated virtually, as the shape is one of the best indicators of a patient's posture. From the current seating posture, the propulsion analysis system estimates the posture, driving force, and muscular forces necessary to propel the wheelchair. Basic hardware and software for the pneumatically controlled functions have been developed for the posture changing system, and the displacements of the human body were measured by a 3D motion analysis system when four airbags were filled with air independently. A method to estimate the spinal shape by the finite element method (FEM) using beam elements has been developed for the seating posture analysis system. This method has a fast processing time and takes external forces into consideration. A method that can estimate the position of the neutral axis of the spine from markers placed on body surfaces was also developed. For the propulsion analysis system, propulsion motion and muscular forces of a subject in the wheelchair with a seat cushion or a back seat cushion were analyzed. Future work includes the development of the remaining functions, such as the overlay display function of the video camera images and sensor data, and the integration of the entire system.

5: 6 Robust tuning of expanding active contour model for tracking lower limb vein in ultrasonographic image

Kengo Ohnishi*, Kazuhisa Nojima**
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**Okayama Prefectural University, 111, Kuboki, Souja, Okayama, 719-1197, Japan

This paper reports on the performance of the developed automated measurement system for vein tracking in ultrasonographic image. We target to monitor the venous flow in B-mode ultrasonograhy and set our technical challenge to assemble image processing algorithms, including the expanding Active Contour Model, to extract the vein contour. Parameter Design method is applied to analyze and select factor's optimal level. Confirmation test was conducted to compare the optimal and initial

Friday November 23

Coffea
DPS (Digital Product Simulation) *D000 - 9h00 - 9h30*
Parallel sessions *9h30 - 11h00*

Session E1 D100 Measurement techniques	Session E2 D101 Control	Session E3 D102 Supervision 2	Session E4 D103 Manufacturing & production

Coffee Break
Parallel sessions *11h30 - 13h00*

Session F2 D100 Robotics 2	Session F3 D101 Simulation 2

LUNCH

Morning 9:00-10:30

Session E1: Measurement Techniques
Chairman: T. Murakami, Keio University

; 6" Transparent film thickness measurement by three-wavelength interference method: An extended application of Global Model Fitting algorithm
Katsuichi Kitagawa
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Conventional transparent film thickness measurement methods such as spectroscopy are basically capable of measuring a single point at a time, and the spatial resolution is limited. We propose a novel areal film thickness measurement method by extending the Global Model Fitting algorithm developed for three-wavelength interferometric surface profiling. It estimates the film thickness distribution from a color image captured by a color camera with three-wavelength illumination. The validity of the proposed method is demonstrated by computer simulations and actual experiments.

535" A Robot-Based Measurement System For the Reflectance-Spectroscopic Characterization of Livores Mortis
M. Wülker[1], K. Böhler[1], M. Bohnert[2], A. Liehr[3]
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The intermittent and long-term spectroscopic observation of light reflected from livor mortis is hoped to help with the determination of the time of death or its circumstances like e.g. CO poisoning. A mobile measurement system with a robot for the required movements has been assembled and thoroughly tested at the Offenburg University of Applied Sciences. It has been operated reliably for 36 hours continuously recording spectra and taking temperature and distance measurements every 20 minutes. The system has been delivered to the collaboration Institut für Rechtsmedizin at the University of Würzburg for field studies.

5; 9" Algorithm for signal processing of long-range fiber optic displacement sensor

N. Arora, L. Petit, M. U. Khan, F. Lamarque, C. Prelle

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An algorithm for signal processing of long-range fiber optic displacement sensor is described in this paper. The algorithm analyses two signals provided by a measurement system which contains two Fiber Optic Probes (FOPs) placed in front of micro fabricated gold coated silicon grating and determines the displacement of the mobile part online. The algorithm provides a scheme of switching between the two signals from the two probes in their respective high sensitivity zone, without interrupting the displacement measurement. An approach is adapted in order to achieve millimetric range with nanometric resolution which also prevents the noise effects on the measurement making the algorithm reliable.

Session E2: Control

Chairman: J. Hirai, Mie University

62" Control of a Teleoperation System by State Convergence with Variable Time Delay

J. C. Tafur[1], C. E. García[2], R. Aracil[2], R. Saltaren[2]

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In this paper, we propose a novel control scheme for bilateral teleoperation of n degree-of-freedom (DOF) nonlinear robotic systems with time-varying communication delay. We consider that the human operator contains a constant force on the local manipulator. The local and remote manipulators are coupled using state convergence control scheme. By choosing a Lyapunov Krasovskii functional, we show that the local-remote teleoperation system is asymptotically stable. It is also shown that, in the case of reliable communication protocols, the proposed scheme guarantees that the remote manipulator tracks the delayed trajectory of the local manipulator. The time delay of communication channel is assumed to be unknown and randomly time varying, but the upper bounds of the delay interval and the derivative of the delay are assumed to be known.

93" Integral sliding mode antisway control of an underactuated overhead crane system

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This paper presents an antisway control strategy for underactuated overhead crane systems. Moving the suspended load along a predefined trajectory is not an easy controlling task due to the residual swing at the end of traveling. In this paper, a robust scheme, based on integral sliding mode control and trolley disturbance observer, is derived to guarantee a fast and accurate load transfer in spite of system uncertainties and actuator nonlinearities. In association with the trajectory tracking control law, a generalized twisting algorithm guarantees the practical stability of the load sway error dynamics. A complete analysis of stability of the closed-loop system is done using the Lyapunov theory. Experimental results are presented to show the advantages of the antisway integral sliding mode controller with the trolley disturbance observer by comparing its effectiveness with a conventional approach, based on a PD controller.

47: " Embedded Control System Design for the Band Saw with Hydraulic Drive

P. Noskievič, M. Szymeczek

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The paper deals with the design of the embedded control system for the control of a band saw for metal cutting. The speed control of the cutting process using the hydraulic drive is described in more details.

567" Robust Mixed-Sensitivity Gain-Scheduled H∞ Tracking Control of a Nonlinear Time-Varying IPMSM via a T-S Fuzzy Model

Vahid Azimi[1], Ahmad Fakharian[2]

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This article presents a robust Mixed-Sensitivity Gain-Scheduled H∞ controller design method by using Loop- Shaping methodology for a class of MIMO uncertain nonlinear Time-Varying systems. In order to design of this controller, first via Takagi and Sugeno's (T-S) fuzzy approach the nonlinear parameter-dependent plant is represented by several linear sub systems. After that, Loop-Shaping methodology and Mixed-Sensitivity problem are introduced to formulate frequency-domain specifications and a systematic design for choosing weighting matrices is presented. Then a H∞ controller is

employed by using linear matrix inequality(LMI) approach for each linear subsystem. Such controllers are said to be scheduled by the Time-Varying parameter measurements in real time. Parallel Distributed Compensation (PDC) is used to design the controller for the overall system and the total linear system is obtained by using the weighted sum of the local linear subsystems. Several results show that the proposed method can effectively meet the performance requirements like robustness, good load disturbance rejection responses, good tracking responses and fast transient responses for the 3- phase interior permanent magnet synchronous motor (IPMSM) system. In addition, the superiority of the proposed control scheme is indicated in comparison with the feedback linearization controller, the H2/H∞ Controller and the H∞ Mixed-Sensitivity controller methods.

Session E3: Supervision 2
Chairman: H. Tomita, Tokyo Denki University

427" White Uniformity Evaluation of Electronic Displays Based on S-CIELAB Color System

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A novel method that evaluates white uniformity grade of electronic displays based on S-CIELAB color system is presented. The spatial filter is defined by using the color contrast sensitivity function, and the mura (non-uniform region) index E is also defined to evaluate the white uniformity grade quantitatively. The experimental results showed strong relations between human sensory evaluation scores and the mura index E values.

575" Fault detection in rotating machinery using spectral modeling

Franz Dietel[1], Rico Schulze[2], Hendrik Richter[1] and Jens Jäkel[1]
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Fault detection and condition monitoring is crucial for a secure and economic operation of mechatronic systems such as rotating machinery. For this purpose sensors gather the physical condition of the machinery. This sensor signals are interpreted by the machineries control system which can trigger a reaction on the fault event. The global propagation of mechanical fault indicators over the casing make vibrational measurements ideal for an obtainment of the whole system. But due to the signal corruption in noisy environment it is a challenging task to process this vibrational data, especially when no explicit process knowledge is available. The process model free framework presented in this work takes advantage of specific fault signatures like frequency modulation. To identify this modulation a spectral prediction algorithm is proposed. Normalizing the prediction error of each spectral component adjust the algorithm to the machinery casing transfer characteristics. In this way also process noise can be suppressed effectively. These features are used to indicate changes in the process state and faults. In addition to the framework a sample implementation is presented and evaluated on centrifugal compressor and bearing datasets. The results show an advantage in detecting compressor surge or bearing fault in comparison to kurtosis statistics, especially in the case of a high noise level or weak fault signatures.

639" SysML and Safety Analysis for Mechatronic Systems

Faïda Mhenni[1], Jean-Yves Choley[1], Alain Rivière[1], Nga Nguyen[2], Hubert Kadima[2]
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Model-based system engineering is an efficient approach to specifying, designing, simulating and validating mechatronic systems. This approach allows errors to be detected as soon as possible in the design process, and thus reduces the overall cost of the product. Uniformity in a complex mechatronic project, which is by definition multidisciplinary, is achieved by expressing the models in a common modeling language such as SysML. This paper presents the state of the art of integrating risk and reliability studies with SysML in the design process of safety critical systems. An Electro Mechanical Actuator system for light aircraft is used to illustrate the integration process, showing how a failure modes and effects analysis is automatically carried out from SysML structural and behavioral diagrams. Through our industry-relevant case study, the advantages and drawbacks of the employed integration methodology are analyzed.

Session E4: Manufacturing & Production
Chairman: O. Tsunoda, Tokyo Denki University

: 8" Study on reduction of stress accumulation while at work in the production

Yuji Sawaguchi, Okitoshi Tsunoda
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This paper describes an important subject to reduce the stress accumulation in the production and also to remove a human error caused by the stress. Recently a manufacturing innovation has happened due to customer satisfaction. Currently Market-in oriented production is implemented instead of Product-out production. In the past, a high volume production was implemented. And now production companies have to provide customer satisfaction with a flexible production to produce variety of products to meet the customer demands. Therefore human operation becomes more important, especially human work quality. (1)Therefore we have to pay an attention for the workers to reduce a miss operation caused by the stress and fatigue while at the work in the production. We thought that a traditional production method was focused on an efficiency for the high volume production but it is not suitable for the flexible production. We try to find the reduction of the stress accumulation and the fatigue of the work in the production.

339" Fabrication of a Micropellistor with MEMS-Based Microhotpalte Applying the Technology of Micro-Fluidics Digitalization

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The size of the microhotpaltes based on MEMS is micron-grade, typically rectangular membrane of $270\mu m \times 70\mu m$, in micropellistors. Coating catalytic materials on the microhotplate appeared to be an extremely critical step in practice. We report a promising approach for coating catalytic materials on the microhotplate of micropellistors in the paper. A catalytic material coating apparatus was established according to the Technology of Micro-Fluidics Digitalization. In this apparatus, the catalytic materials, finely dispersed Al_2O_3 suspension and platinum palladium catalyst, were ejected out a micro-nozzle by the pulse inertia force produced by a piezoelectric actuator. The micro-nozzle is fabricated by glass heat process and has the advantages of won't being corroded after being exposed in air for long time, won't pollute the chemical solution in it and being of low cost. The porous Al_2O_3 matrix thickness and the amount of catalyst can be controlled accurately in this apparatus. The micropellistor with original signal of 75mV was fabricated in this paper and 36mV was remained after aging treatment. The power consumption can remain 75mW as well.

34: "Rapid Manufacturing of Mechatronic Components – Applications of Stereolithography

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Mechatronics is based on the integration of mechanics and electronics. Because of the geometric complexity of the modules of mechatronics it is challenging to apply additive manufacturing. Additive fabrication techniques can help to produce rapidly customized mechatronic components. If the principle of the additive process is considered in the early state of the product development, novel design concepts are opened up, which cannot be realized by conventional machining methods. The focus of this study is to evaluate the actual potential of stereolithography for the rapid manufacturing of gears, pneumatic actuators, electropneumatic sensors and other equipment needed for the integration into mechatronic systems. The opportunities and limitations of stereolithograpy for the rapid manufacturing of such components are discussed in this paper.

Morning 11:00-12:30

Session F2: Robotics 2

Chairman: A. Ming, University of Electro-Communications

357 Controlled Bi-articular Robot Arm with Planetary Gear

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In conventional robot arms, one motor is placed in one joint. The other hand, the human upper extremities with bi-articular muscles bind on shoulder and elbow. However, we have introduced the robotic arm with planetary gear imitated bi-articular muscles. The two-link arm with three-actuator has a redundant mechanism. This paper reports on 2 methods for sharing of arm tip force. One is method to minimize 2-norm. The other is equipotential method that has motor gain to decide much the same direction of displacement and force. The 2-norm method shows smaller torque than the other one. The trajectory of the arm tip is plotted close to our target. As a result, the 2-norm method in trajectory control and the motor gain method in compliance control are integrated to produce much advantageous control.

38; "Quantitative Analysis of the Force Control Capability of Standard Industrial Robot Axes

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Force control is an essential feature for industrial robotics on its way towards new and challenging applications. However, in the field of industrial robots there is only very limited information available on the performance and limitations of industrial robot systems operated in force control mode. Against this background, the paper discusses the force control ability of standard industrial robot axes. Based on experimental analysis of two standard industrial robots (Reis RV6L, Reis RL50), this paper discusses the influence of the mechanical design, the feed-in level on joint space as well as the cycle time of the force controller on the overall force control performance. Investigations have been based on three different contact scenarios: "manual guidance","contact with a rigid environment" and "impact".

4; ; "Realization of Robotic Yoyo Operation based on Analysis of Human Motion

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This study aims to realize a yoyo operation by an arm type robot, and we focus on actions of human arms playing yoyo. A fundamental yoyo operation called "gravity-pull", freely dropping a yoyo and pulling back, is realized. In our previous research, the joint torque tends bigger than the maximum torque of actuators. Therefore a human arm motion is observed to resemble a 3-links manipulator, and its equation of motion is derived. Considering its inverse system, the joint torque of the human arm can be calculated from measurements of the human arm by a motion capture system (MCS). Searching parameters of an arm type robot (PA10), the necessary torque for the PA10 to mimic human yoyo operations is estimated. The estimated torque in simulation give us the information on an adequate specification of a robot playing yoyo.

Session F3: Simulation 2
Chairman: C. Prelle, Université de Technologie de Compiègne

49" Energy-optimal time allocation of a series of point-to-point motions: demonstration on a badminton robot

Pieter Janssens[1], Goele Pipeleers[1], Moritz Diehly[2], Gregory Pintez[3] and Jan Swevers[1]
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We consider the problem of energy-optimal time allocation of a series of point-to-point motions. When performing a series of point-to-point motions, the individual execution time of each motion is, in many cases, free to choose as long as the total execution time of the series of point-to-point motions is not exceeded. This paper presents an algorithm to compute the time allocated to each motion in a series of point-to-point motions in an energy-optimal way. The algorithm is demonstrated on a technology demonstration test facility at Flanders' Mechatronics Technology Centre.

9: Effectiveness of an interval computation approach to the dynamic simulation of a MacPherson Suspension system

Hassen Trabelsi[1,2], Pierre-Alain Yvars[1], Jamel Louati[2] and Mohamed Haddar[2]
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In this paper, a new design approach based on methods by intervals adapted to the integration of a simulation step at the earliest stage of preliminary design for dynamic systems is proposed. The general idea consists in using the interval computation method to make a simulation by intervals in order to minimize the number of simulations. These intervals represent the domains of possible values for the design parameters of the system. So the parameterized model of system is solved by interval. This avoids launching n simulations with n values for each design parameter. The proposed method is evaluated by several tests on a scalable numerical example. It has been applied to solve parameterized differential equations of a Macpherson suspension system and study its dynamic behavior. The dynamic model of the MacPherson suspension is nonlinear but linearisable. It was transformed into a parameterized state equation by intervals. The solution to this state equation is given in the form of a matrix exponential. Three digital implementations of exponential have been tested to obtain convergent results. Simulations results are presented and discussed.

494 Evaluation of a Betaless Instantaneous Cornering Stiffness Estimation Scheme for Electric Vehicles

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This contribution evaluates a new beta-less InstantaneousCornering Stiffness (ICS) estimation scheme. It relies on the availability of the lateral tire forces measurement which in near future can be realized with economic (low cost) sensors. The estimation is only available if the change in the tire slip angle is profound enough as it is not the case during constant cornering. However, as it is shown with simulation and experimental results the ICS can be estimated in important vehicle dynamic situation and the information used for lateral tire force saturation detection and control. Additionally, it could be used to shorten the convergence time of "linear" cornering stiffness estimation schemes. Since it requires some derivatives of measured signals, a special signal processing techniques must be applied to overcome inaccuracy due to sensor noise.

4: 8" Simulations for Developing the Fog Sensor NebioSens
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In this paper mainly simulations for developing the fog sensor NebioSens are presented. After some basic principles of light barriers, alternating beam technology, and fog the first ideas of a mechanical construction for sensor housing are shown. Then some single particle simulations with Mie scattering open the simulation results. Furthermore, ensemble simulations for