

**RESÚMENES EN INGLÉS**  
**ENGLISH ABSTRACTS**

**INVERSION, A UNIFYING CONCEPT IN AUTOMATIC CONTROL TEACHING**

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**Abstract:** This is a paper on fundamental concepts in Automatic Control teaching. In particular, it is claimed that the concept of inversion plays a key role in the design of control systems. This claim is supported by examining how inversion underlies all approaches which are currently used to solve the control design problem. It is argued that the understanding and handling of this concept allows to teach the discipline, regardless the existing variety of approaches and design methods. *Copyright © 2006 CEA-IFAC.*

**Keywords:** Inversion, feedback control, design, multivariable control, automatic control teaching.

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**PARALLEL ROBOTS: MACHINES WITH A PAST FOR A FUTURE ON ROBOTICS**

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**Abstract:** This paper presents a general vision of robots with a parallel mechanical structure, pointing out the differential features with the well-known open-kinematic chain robots. The goal of the paper is to be used as a review of the developments made by the authors with parallel robots. First, a historical general introduction of this kind of robots is made. Next, some aspects of the kinematic model are reviewed, with special interest on the application of the theory of screws to these devices. Finally, several industrial applications and prototype developments are shown. *Copyright © 2006 CEA-IFAC.*

**Keywords:** Parallel robots, kinematic model, screw theory.

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**EXPERIENCES ON BILATERAL TELEOPERATION OF ROBOTS****Emanuel Slawiński, José Francisco Postigo, Vicente Mut***Av. Libertador San Martín 1109 (oeste), San Juan, Argentina**Zip Code: J5400ARL**Phone: +054-264-4213303**Fax: +054-264-4213672**E-mail: slawinski@inaut.unsj.edu.ar*

Abstract: In this paper, the design and development of a system applied to robots teleoperation through Internet is presented. In addition, a model of the Internet time delay is proposed, which is tested from real data. Finally, the results obtained from teleoperation experiments using two robots placed on different cities (Verona and Rome, both in Italy) and linked via Internet are shown. *Copyright © 2006 CEA-IFAC.*

Keywords: bilateral teleoperation, Internet, UDP protocol, time delay.

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**AN APPLICATION OF GENETIC ALGORITHMS TO ROBUST CONTROL DESIGN****Miguel A. Martínez, Javier Sanchis, Xavier Blasco***Grupo de Control Predictivo y Optimización Heurística (CPOH)**Departamento de Ingeniería de Sistemas y Automática**Universidad Politécnica de Valencia**Camino de Vera 14, 46022 - Valencia, España**e-mail: mmiranzo@isa.upv.es <http://ctl-predictivo.upv.es>*

Abstract: Physical Programming (PP) is a multiobjective optimization technique where the designer, for each objective or specification of the problem, declares his preferences in a flexible way. These preferences (e.g. overshoot, settling time, gain margin) are expressed with linguistic terms such as tolerable, desirable, undesirable, etc. and they are associated with numeric ranges in the same physical units as the objective itself is (e.g. seconds, percentages). This paper shows how PP can be applied to the design of robust controllers from a multiobjective optimization point of view. Non linear optimization used in the original PP method has been substituted by a Genetic Algorithm to avoid local minima which can usually arise in these multimodal problems. The ACC Robust Control Benchmark has been solved and the result obtained is compared with solutions from other authors. *Copyright © 2006 CEA-IFAC.*

Keywords: Robust control, multiobjective optimization, Physical Programming, Genetic Algorithms

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**PREDICTIVE-ADAPTIVE CONTROL ALGORITHM IN THE PSEUDO-STATE SPACE****Alberto Aguado**

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Abstract: In this paper, a predictive-adaptive controller based on a so called "pseudo-state space" model is described. The proposed algorithm has, among other advantages, the fact that the square root of the Riccati matrix is propagated instead of the whole matrix; in this way, its numerical robustness and computational efficiency are enhanced. Two possible applications of the proposed algorithm are discussed in the paper: The control of the Kappa number of a continuous digester, that is an strongly non linear process with a great pure time delay and whose parameters changes in dependence of the raw material composition, and a multiple-effect evaporator control which is a multivariable object with strong interactions among its variables and whose dynamics change slowly with time. A Simulink version of the controller was applied in both cases and the simulation results show the practical possibilities and the qualities of the proposed method. *Copyright © 2006 CEA-IFAC.*

Keywords: predictive control, adaptive control, pseudo states, least squares, continuous digester, Kappa number, multivariable control, múltiple effect evaporators.

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**ITERATIVE MODEL BASED PREDICTIVE CONTROL. APPLICATION TO BATCH PROCESSES.****José R. Cueli, Carlos Bordons.**

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Abstract: This paper shows an approach to batch control that is based on nonlinear Model Predictive Control. It can be applied to a family of nonlinear systems subject to repetitive disturbances. Some features of repetitive control have been added to this controller in order to cancel repetitive disturbances. It is based on the process model and has the ability to learn from past batches. The paper demonstrates that the proposed controller is able to stabilize any linear system as well as any nonlinear plant, control affine and with linear output function. An experimental application on a laboratory plant is presented. *Copyright © 2006 CEA-IFAC.*

Keywords: Predictive control, learning control, batch control.

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**DESIGN OF FUZZY CONTROL SYSTEMS: PLANT MODEL****José M. Andujar, Antonio J. Barragán, Juan M. Córdoba, Iñaki Fernández de Viana**

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**Abstract:** In this report, the authors present a methodology that allows the fuzzy modeling as state equations of a nonlinear multivariable control system. The mathematical formalization of the fuzzy control system is totally developed, without any restrictions, neither in state vector of the plant nor in the control. About the identification of the plant model parameters two techniques have been studied: a classic approach based on gradient descent and a new hybrid modeling technique that uses Ant Colony Optimization (ACO) with gradient descent.  
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**Keywords:** identification, ant colonies, modeling, neurofuzzy

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**COMMUNICATION LINK EFFECTS IN A NETWORKED CONTROL SYSTEM USING PROFIBUS-DP****V. Casanova, J. Salt, V. Mascarós, A. Cuenca**

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**Abstract:** Networked control systems are a special kind of control systems where a shared communication medium is used by several devices and/or the controller is located far of the controlled plant and, moreover, a reliable and safe communication medium is necessary. In this paper, by means of a theoretical model, networked control system operation using PROFIBUS\_DP protocol is described. Moreover, via several real implementations, the network bandwidth effect over controller performances when transmission rate is varied it is studied. Phenomena like delays, loss of signals and extension of control actions application time are observed.  
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**Keywords:** Networked control systems, communication networks, fieldbuses, industrial automation.

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**SHADES-3D: A MATLAB<sup>®</sup> TOOLBOX FOR 3D DATA ACQUISITION**

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**Abstract:** This paper presents a toolbox working with MATLAB<sup>®</sup> allowing 3D data acquisition using active vision techniques. The system is built with low cost components: a webcam connected to one PC USB port, a lamp, two reference planes and a stick. Another advantage is that it is not necessary to know the position of the light source, and just a camera calibration stage is required. It means that it can be used in not very complex working environments. On the other hand, the developed program includes a graphic interface to facilitate its use and learning. *Copyright © 2006 CEA-IFAC.*

**Keywords:** 3D Vision, Active Vision, Range Data.

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