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RESÚMENES EN INGLÉS
ENGLISH ABSTRACTS

A REVIEW OF THE STATE OF THE ART IN OPTIMIZATION

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Abstract: This paper presents a review of the most important optimization techniques: linear and nonlinear programming with and without discrete variables and of the algorithms available, to the date, for solving those problems. Besides an extension to deal with problems formulated in terms of disjunctions and logical relationships, deterministic and stochastic global optimization and optimization in problems without a define structure is included together with a general view of the algebraic modelling systems. *Copyright © 2007 CEA-IFAC.*

Keywords: Optimization, LP, NLP, MINLP, MILP, Generalized Disjunctive Programming, Global Optimization.

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NETWORK THEORY IN CONTROL ENGINEERING: APPLICATIONS IN DYNAMIC ANALYSIS AND PROCESS CONTROL

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Abstract: Processes in chemical, food or biotechnology industry, as well as many of the mechanisms characteristics of system biology, belong to the so-called process systems class. In this contribution, use is made of a number of previous results that combine aspects from systems and graph theory with methods from thermodynamics and reaction networks to set up the basis on which to develop a formal and generalized representation of processes in terms of complex networks.
This representation –partially developed by other authors- not only allows the unification of a wide number of apparently diverse processes, but also provides an efficient and systematic approach to undertake decentralized control problems as well as advanced dynamic analysis (including bifurcation analysis). *Copyright © 2007 CEA-IFAC.*

Keywords: Complex networks, process systems, dynamic analysis, bifurcation analysis, decentralized control

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APPLICATION OF ADAPTIVE CONTROL TO 2DOF HELICOPTER MODEL

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Abstract: This paper presents adaptive control results obtained in the framework of CROMAT and COMETS projects. It is shown the application of the adaptive control technique developed by Calise to control a helicopter model with two degrees of freedom. The technique uses feedback linearization, linear compensation and adaptive-neural-network compensation. This work shows that a simple plant model is enough, since the neural network compensates modelling deviations completely on-line and therefore without initial training.

Keywords: helicopter, neuronal network, output feedback, nonlinear control, adaptive control

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MODELLING AND STABILIZATION OF A MINI HELICOPTER HAVING FOUR ROTORS

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Abstract: We present in this paper a nonlinear control algorithm to stabilize a mini-helicopter having four rotors. The control strategy is based on the Lyapunov analysis and on a nested saturation functions. The control law is simple to implement and very easy to tuning with respect to the others proposed in the literature. The proposed strategy has been successfully applied to the mini-rotorcraft, and the experimental results have shown that the controller performs satisfactorily even when significant disturbances are introduced into the system. Further, experimental results show that the proposed nonlinear controller performs better than an LQR linear controller.

Keywords: Helicopter, Lyapunov Analysis, UAVs, Real-time.

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ADAPTIVE FUZZY SLIDING MODE CONTROLLER FOR THE KINEMATIC VARIABLES OF THE UNDERWATER VEHICLE SNORKEL

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Abstract: This paper address the kinematic variables control problem for the low-speed manoeuvring of a low cost and underactuated underwater vehicle. Control of underwater vehicles is not simple, mainly due to the non-linear and coupled character of system equations, the lack of a precise model of vehicle dynamics and parameters, as well as the appearance of internal and external perturbations. The proposed methodology makes use of a pioneering algorithm in underwater vehicles, which is based on the fusion of a sliding mode controller and an adaptive fuzzy system, including the advantages of both systems. The main advantage of this methodology is that it relaxes the required knowledge of vehicle model, reducing the cost of its design. The practical system is based on a semi-decoupled non-linear plant model of the Snorkel vehicle and it is compounded by tree independent controllers, each one for the tree controllable DOF of the vehicle. The experimental results demonstrate the good performance of the proposed controller, within the constraints of the sensorial system and the uncertainty of vehicle theoretical model.

Keywords: Sliding mode control, adaptive equalization, fuzzy models, robots dynamics, marine systems.

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CONTACT FORCE ESTIMATION FOR COMPLAINT ROBOT MOTION CONTROL

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Abstract: It is well known that for a robotic manipulator without sensors on the end-effector, the end-effector has to follow a path in its workspace without regard to any feedback other than its joints shaft encoder or resolvers. This fact imposes severe limitations on certain tasks where an interaction between the robot and the environment is needed. However, with the help of sensors, a robot can exhibit an ”adaptive behavior”, the robot being able to deal flexibly with changes in its environment and to execute complicated skilled tasks. In this paper, we firstly propose a new control strategy based on multisensor fusion with three different sensors—that is, encoders mounted at each joint of the robot with six degrees of freedom, a wrist force sensor and an accelerometer—whose goal is to obtain a suitable contact force estimator for the three Cartesian axes. Secondly, the corresponding self-calibration method developed for the commented contact force observer is also proposed. This procedure aims at offering a ‘plug-and-play’ solution for the integration of different kind of accelerometers with the final goal of obtaining an observer capable of estimating the contact force exerted by an industrial robotic manipulator. To validate both the behaviour of the contact force observer and the performance of the self-calibrating procedure, different experiments were carried out on an ABB industrial robot with open control system architecture.

Keywords: Force Sensing, Sensor Fusion, Self-Calibrating Procedures, Robot Control.

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HETERARCHICAL APPROACH TO A MULTI-AGENT BASED CONTROL FOR MANUFACTURING SISTEMS: THE NEW PROHA METHODOLOGY

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Abstract: Recent research on highly-distributed control methods for complex systems have produced a series of philosophies based on negotiation, that bring together process engineering with computer science. Among these control philosophies, the ones based on multi-agent systems (MAS) have become especially relevant. However, these MAS models have the drawback of an excessive dependence on up-to-date information about the products and other elements that move within the system. A new technology has come out that can help solve this problem: radio-frequency identification enhanced information management systems (RFID-IMS). One of these is Auto-ID/EPCglobal technology. This technology is being widely deployed for logistic applications; but once in place, manufacturing control can benefit so deeply that MAS´s are called to become widespread solutions for improving the flexibility of manufacturing environments. This paper presents a methodology for negotiated control of highly distributed systems that uses RFID to guarantee the adequate access to information by all parts.

Keywords: Manufacturing, Distributed Control, Agent-Based Control, RFID.

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FREE FORM OBJECT RECOGNITION FROM PARTIAL VIEW RANGE DATA USING WEIGHTED CONE CURVATURES

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Abstract: In this work we present a method for free-form object recognition from range data of one partial view. To do this, a new feature, called Weighted Cone-Curvature (CCW), is introduced. The CCW measures the angle supported for the nodes of the mesh. Because of the fact that the information is not complete, it is necessary to apply a technique based on principal components. Finally, the ICP algorithm is applied. These two last steps of the algorithm solve not only the recognition problem, but also the localization one.

Keywords: Recognition, matching, range data, 3D vision.

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EXTENSION OF THE CONTROLLER DESIGN BENCHMARK FOR THE PITCH ANGLE ON A HELICOPTER.

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Abstract: This paper complements the one appeared in RIAI Vol. 3, Num. 2, pp 111-116, 2006, about the control of the pitch angle of a laboratory helicopter. It presents a more detailed model of the system that will allow the designers to obtain advanced controllers. In addition, the evaluation function of the benchmark is modified to weight the control objectives in a balanced way. The extended benchmark is proposed as the Mathworks Prize to the best design for the benchmark "Control engineering 2007", for which a new deadline is established.

Keywords: Controller design, benchmark, helicopter control

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