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RESÚMENES EN INGLÉS
ENGLISH ABSTRACTS

A METHODOLOGY FOR INTEGRATED SYSTEM IDENTIFICATION WITH IMC-PID CONTROLLER DESIGN

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Abstract: This paper describes, in tutorial fashion, an integrated identification and control design methodology that begins with dynamic modelling from plant data and concludes with parameter settings for high performance PID controllers. By integrating identification with PID controller design, the method displays functionality that is often demanded by the practicing engineering community. The major steps in this integrated methodology are: experimental design, high-order ARX estimation, and control-relevant model reduction leading to models that comply with the IMC-PID tuning rules. When a persistently exciting input is applied, high-order ARX model estimation is consistent, which makes it an attractive intermediate model for control-relevant model reduction purposes; furthermore, the low computational effort associated with ARX estimation means that simple statistical tools (such as cross validation) can be used to efficiently determine a suitable structure for the ARX model without substantial user intervention. The methodology is illustrated for the case of a delayed plant subject to a disturbance displaying significant drift. *Copyright © 2007 CEA-IFAC.*

Keywords: system identification, PID control, model reduction, control-relevant modelling, Internal Model Control (IMC).

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CONTROL OF COOPERATIVE ROBOTS WITH OBSERVER DESIGN.

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Abstract: One of the main problems regarding the implementation of control laws to carry out dexterity tasks with robots is the complexity in integrating a large quantity of sensors in small architectures. Besides, operation costs are increased. In this paper, control of cooperative robots without velocity measurements is considered, with the aim of manipulating a rigid object. The developed theory is tested by means of experimental results. *Copyright © 2007 CEA-IFAC.*

Keywords: Control of cooperative robots, observer design

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DISCRETE-TIME SLIDING MODE CONTROL FOR THE PATH TRACKING OF A MOBILE ROBOT.

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Abstract: A discrete-time sliding mode controller is presented which solves the path tracking problem for a remotely controlled wheeled mobile robot. The control strategy is based on the exact discrete-time model of the mobile robot, including the transport delay induced by the communication network. The proposed controller guarantees asymptotic convergence of the tracking errors. The performance of the controller is evaluated through numerical simulation.

Keywords: mobile robot, transport delay, discrete-time control, sliding modes.

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SYSTEM STIFFNESS AND CORRECTIONS FREQUENCY INFLUENCE IN FORCE CONTROL OF INDUSTRIAL ROBOTS

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Abstract: This paper addresses the implementation of force control in industrial robots with an existing position control. The environment-robot system stiffness during the contact and the rate at which corrections of Cartesian trajectories is allowed, impose key constraints on the force servo gains and therefore limit system performance.

Simulations are used to gain insight into this problem and analyze previous experimental results obtained with a last generation industrial robot equipped with a wrist force-torque sensor.

Keywords: robotic manipulators, force control, system stiffness, corrections frequency.

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APPLICATION OF ROBOTICS THEORY TO HUMAN ARM BIOMECHANICS

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Abstract: This article presents the application of a number of techniques commonly used in robotics, to the study of human arm motion. The human arm is modelled as a redundant robotic manipulator. In particular, the concept of performance indexes is applied to the prediction of optimal postures of the arm during its motion. Both, static postures and posture sequences are considered for the optimal trajectory formulation.

Keywords: Arm motion, Arm trajectories, Performance indexes

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MODELLING, IDENTIFICATION AND CONTROL OF ELECTRO PNEUMATIC LINEAR ACTUATORS. APPLICATION IN TOW DEGREE OF FREEDOM PLATFORM.

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Abstract: This paper is meant to present a method of analysis and design of a controller for linear electro-pneumatic actuators. The characterization is based on a physical-mathematical model of the system using a new approach: without averaging the time constants of the cylinder chambers and taking into account the underlap effect of the valve spool. With this model it is shown a more precise description of the system dynamics. To perform the validation, the system is subject to experimental identification using different positions of the cylinder piston in a real electro-pneumatic test bed. In addition to this, it is proposed a lineal pole place regulator based on the model. The method of control is validated in the test bed and later on is introduced in a two degree of freedom industrial platform (drive simulator) with satisfactory results.

Keywords: Electro-pneumatic system, modelling, close-loop identification, control.

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CONSTRUCTIVE FEEDBACK LINEARIZATION OF UNSTABLE UNDERACTUATED-DEGREE-ONE MECHANICAL SYSTEMS WITH FRICTION

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Abstract: In the last years, several methods to control nonlinear underactuated mechanical systems have been developed. In fact, these nonlinear methods have solved interesting control problems. Nevertheless, the solutions of these methods relies on solving a set of partial differential equations, which is not always possible. This article presents a constructive methodology to control a class of unstable underactuated mechanical systems with underactuation degree one. The design is based on classical feedback linearization and Lyapunov redesign. The methodology is based on proposing a dummy output that allows its redesign in a constructive way to solve the problem, giving rise an explicit and compact control law that allows to take into account the friction even in the underactuated coordinates.

Keywords: Nonlinear systems, Underactuated Mechanical Systems, Feedback linearization, Lyapunov redesign

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MOTION TEXTURES: MIXED-STATE MARKOV FIELDS AND SEGMENTATION

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Abstract: The aim of this work is the modelling of motion in image sequences that show some stationary and homogeneous dynamic. We adopt the mixed-state Markov Random Fields (MRF) models to represent the so-called motion textures. The approach consists in describing the spatial distribution of some motion measurements which exhibit values of two types: a discrete component related to the absence of motion and a continuous part for measurements different from zero. We propose several significant extensions to this model and apply it to the problem of motion texture segmentation on synthetic and real sequences.

Keywords: Markov Random Fields, segmentation, dynamic textures.

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ACTIVE NOISE CONTROL IN A HYDRAULICS INSTALLATION

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Abstract: This article describes the experimentation with several active noise control strategies in a hydraulics installation, characterized by its time-variant nonlinear dynamics. The primary objective of the control system concerns the elimination of the fluid-borne noise responsible of undesired vibrations in the pipe located down-stream with respect to the radial oil pump. The actuating signal is generated by an oil pressure wave generator coupled to the pipe. The comparison of different control strategies is performed in terms of stability, speed and success in noise compensation. The experimentation, both in simulation and through a hardware-in-the-loop framework, validates the different control strategies proposed.

Keywords: Hydraulics installation, active noise control, automatic control, Matlab/Simulink, Tribology.

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NEURO-GENETIC PREDICTIVE CONTROLLER

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Abstract: In this paper, it is presented a solution to the model based non linear predictive control which differs from other approaches in the use of a neural model as predictor and a specially designed genetic algorithm as optimizer. This approach can be used in the case of strongly non linear processes that can not be efficiently approximated by any linear model and it make possible the use of arbitrary, not necessarily quadratic or even analytic criteria, and the inclusion of heuristic ad hoc solutions to improve the results. In the paper, some simulation results of the proposed controller are presented.

Keywords: predictive control, genetic algorithms, neural networks, boiler-turbine units control.

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BIOMODELS IMPLEMENTATION FOR EXPERIMENTAL AND EDUCATIONAL PURPOSES. AN INTERDISCIPLINARY EXPERIENCE

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Abstract: A mathematical model for emulating the endocrine behaviour of healthy persons or patients with Diabetes Mellitus Type I and Type II pathologies is presented accounting the short-term interrelationship between glucose/insulin/glucagon. The basic model structure is compartmental one, where several parameters were adopted based on our own biological models. Three main areas such as Biochemistry, Chemical and Electronic Engineering worked together in a multidisciplinary way. The principal objective is to demonstrate the educative potentiality from each discipline mentioned previously point of view.

Keywords: Mathematical biomedical model Multidisciplinary education Experimentation Predictive control.

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RESULTS OF THE CONTROLLER DESIGN BENCHMARK FOR THE PITCH ANGLE OF A HELICOPTER.

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Abstract: This paper presents the results of the controller design benchmark for the pitch angle of a helicopter, announced in RIAI Vol. 4, Num. 1, pp. 107-110, 2007, and RIAI Vol. 3, Num. 2, pp. 111-116, 2006, and proposed as The Mathworks prize for the benchmark "Control Engineering 2007". *Copyright © 2007 CEA-IFAC.*

Keywords: Controller design, benchmark, helicopter control.

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