RESÚMENES EN INGLÉS
ENGLISH ABSTRACTS

CONTINUOUS PETRI NETS: EXPRESIVENESS, ANALYSIS AND CONTROL OF A CLASS OF SWITCHED LINEAR SYSTEMS

M. Silva, L. Recalde

Instituto de Investigación en Ingeniería de Aragón, I3A,
Dep. de Informática e Ingeniería de Sistemas,
Universidad de Zaragoza, España,
{silva, lrecalde}@unizar.es

Abstract: Petri nets are one of the more broadly accepted formalisms in engineering applications in which discrete event models are suitable, thanks to the existence of powerful analysis and synthesis theories, and to its immediate graphical representation. Nevertheless, sometimes there appear decidability problems, or in largely populated systems, of great computational complexity. In this work, the warp and some fringes of the theory developed for a fluid or continuous relaxation of discrete dynamical models is presented. It allows addressing the study of systems that would be impossible to tackle otherwise, while laying some bridges to concepts and results in performance analysis and synthesis, or to the observation and control of systems called continuous, although the classes of models that are obtained are technically, and sometimes also conceptually, hybrid. Obviously, the price paid for any relaxation is a lose in the fidelity of the models. In this sense, it has to be taken into account that although it is not common in engineering applications, the discrete models may be non continuizable, the same as not every continuous non linear system can be satisfactorily approximated by a linear one (remind, for example, chaotic systems). *Copyright © 2007 CEA-IFAC.*

Keywords: Petri nets, life cycle, mathematical relaxation, structural theory, qualitative analysis, quantitative analysis, parametric optimization, observation and dynamic control.

NONLINEAR PREDICTIVE CONTROL BASED ON VOLTERRA MODELS. APPLICATION TO A PILOT PLANT.

J. K. Gruber, C. Bordons

Dpto. Ingeniería de Sistemas y Automática,
Escuela Técnica Superior de Ingenieros,
Universidad de Sevilla,
Camino Descubrimientos, s/n., 41092 Sevilla, Spain
jgruber@cartuja.us.es, bordons@esi.us.es

Abstract: The present publication demonstrates the application of a nonlinear predictive control (NMPC) strategy based on Volterra models to a pilot plant in which the temperature of the reactor's content is controlled. The control is based on a second-order diagonal Volterra model in order to consider nonlinear effects. To calculate the control action, an iterative method with low computational cost, is used. The behavior of the process and the controller will be presented by means of experimental results. Finally, the experimental results of the NMPC will be compared to the results of a linear model based predictive controller (MPC). *Copyright © 2007 CEA-IFAC.*

Keywords: nonlinear model based predictive control, Volterra series models, pseudo random sequence, identification, pilot plant

ROBUST NONLINEAR CONTROL OF A SCALED HELICOPTER WITH VARIABLE SPEED ROTORS

Manuel López-Martínez, Manuel G. Ortega Linares,
Carlos Vivas Venegas, Francisco Rodríguez Rubio.

Dept. Ingeniería de Sistemas y Automática.
Escuela Técnica Superior de Ingenieros. Universidad de Sevilla.
Camino de los Descubrimientos s/n. 41092-Sevilla.

Abstract: This paper presents the design of a robust nonlinear controller for a scaled helicopter. This device features rotors with fixed angles of attack blades, and is controlled by changing the speed of the rotors using two direct drive engines. The resultant system is multivariable (2 inputs and 4 outputs), highly nonlinear and strongly coupled. The application presented in this paper includes the design of a robust controller that rejects persistent disturbances, which is based on feedback linearization and two external controllers. These controllers have PID structure and are designed using LQR regulators extending the state vector with the integral of the positions. The methodology has been verified by means of experimental results. *Copyright © 2007 CEA-IFAC.*

ROBUST LQR VIA BOUNDED DATA UNCERTAINTIES

C. Ramos, M. Martínez, J. Sanchis, J.V. Salcedo

Department of Systems Engineering and Control,
Polytechnic University of Valencia,
Camino de vera, s/n, 46022 Valencia, Spain
cramos@isa.upv.es

Abstract: This work presents the BDU technique (Bounded Data Uncertainties) and the tuning of the linear quadratic regulator (LQR) via this technique, improving the system robustness. The BDU method is stated as a Min-Max problem where the best solution is sought in the worst scenario. So a new LQR tuning method is offered by taking into account the bounds on the uncertainty. The application to multidimensional systems is not trivial since a two-point boundary value problem (TPBVP) appears, which is solved iteratively. *Copyright © 2007 CEA-IFAC.*

ACTIVE ACOUSTIC NOISE CONTROL IN MOTORCYCLE HELMETS

Rosa Castañé and Ricardo S. Sánchez Peña*

*Departament d'Enginyeria de Sistemes, Automàtica i Informàtica Industrial
Sistemes Avançats de Control (UPC)*

*Institució Catalana de Recerca i Estudis Avançats (ICREA)

Abstract: Based on models and existing experimental data, a feedback-feedforward scheme is applied on the acoustic active noise control of motorcycle helmets. A two-degree of freedom control structure is adopted which inputs a signal proportional to the external helmet noise and also the effective noise in the driver's ear. Designs using the Youla parameterization, H_∞ optimal control and μ-synthesis (design using the structured singular value) are compared. An analysis in terms of performance, robustness and controller order is also performed. *Copyright © 2007 CEA-IFAC.*

Keywords: Active noise control, H_∞ optimal control, Youla parameterization, μ-synthesis (structured singular value)

SOFTWARE OPEN STRUCTURE FOR AN INDUSTRIAL ROBOT

**Emanuel Slawiñski*, José Francisco Postigo,
Vicente Mut, Darío Carestía, Federico Castro**

**Instituto de Automática (INAUT). Universidad Nacional de San Juan.
Av. Libertador San Martín 1109 (oeste). J5400ARL. San Juan, Argentina.
slawinski@inaut.unsj.edu.ar*

Abstract: In this paper the design, implementation and experiments of open software architecture for the control of an industrial robot are presented. The designed software structure allows testing control algorithms and adding new sensors and actuators easily. Such structure is a useful tool for researching and teaching in the robotics area. *Copyright © 2007 CEA-IFAC.*

Keywords: manipulator robot, objects, open software

QUANTIZATION-BASED INTEGRATION OF STIFF SYSTEMS

Gustavo Migoni *, Ernesto Kofman * and François Cellier **

** Laboratorio de Sistemas Dinámicos. FCEIA - UNR -
CONICET. Riobamba 245 bis - (2000) Rosario. Argentina
** Institute of Computational Science - ETH Zürich. CH-8092
Zürich. Switzerland.*

Abstract: This article presents a new numerical method for integration of ordinary differential equations based on state variable quantization. Using the idea of implicit integration, the new method called BQSS (Backward Quantized State Systems) allows integrating stiff systems in an efficient way. Being the first quantization-based method for stiff systems, BQSS is itself an explicit method, so the contribution is important in the general context of numerical integration. Besides introducing the method, the article studies its main theoretical properties, discusses some practical issues related to the algorithm implementation and presents simulation results. *Copyright © 2007 CEA-IFAC.*

Keywords: Numerical Integration Methods, Stiff Systems, Quantization-Based Integration.

A MODEL-BASED STRATEGY FOR STATOR-FAULT DIAGNOSIS IN INDUCTION MOTORS

**Cristian H. De Angelo, Guillermo R. Bossio, Santiago J. Giaccone,
Jorge A. Solsona, María I. Valla and Guillermo O. García**

*Grupo de Electrónica Aplicada,
Fac. de Ingeniería, Universidad Nacional de Río Cuarto,
Ruta Nac. #36 Km. 601, (X5804BYA) Río Cuarto, Córdoba, Argentina
cdeangelo@ieee.org.*

Abstract: A strategy for stator-fault diagnosis in induction motors using only voltages and currents measurements is presented in this paper. The proposed strategy is based on the generation of a vector of specific residual using a state observer. The residual allows the detection of the faulted motor phase and the quantification of the number of short-circuited turns. This strategy is very low sensitive to motor load variation and power supply perturbations. *Copyright © 2007 CEA-IFAC.*

Keywords: Fault diagnosis, stator faults, induction motors.

QUASIPERIODIC SOLUTIONS IN A RESONANT ELECTRIC CIRCUIT

Gustavo Revel, Diego M. Alonso and Jorge L. Moiola

Depto. de Ingeniería Eléctrica y de Computadoras
Universidad Nacional del Sur.
Avda. Alem 1253, (B8000CPB). Bahía Blanca. Argentina.
grevel@uns.edu.ar.

Abstract: In this work, the dynamics of a resonant electric circuit is analyzed. Several bifurcation diagrams associated to the truncated normal form of the double Hopf bifurcation are presented. The bifurcation curves are obtained by numerical continuations. The existence of quasiperiodic solutions with two frequency modes (2D tori), and three components (3D tori) is shown. These last are, in certain way, close in complexity to chaotic solutions. The analysis is complemented with time simulations and a discussion on the interactions of the eigenvalues of the linearized system, as one of the parameters is varied. *Copyright © 2007 CEA-IFAC.*

Keywords: Dynamical Systems, Nonlinear Circuits, Oscillators, Limit Cycles, Resonance.

DYNAMICS OF A BUCK CONVERTER WITH A DIGITAL PI CONTROLLER

María Belén D'Amico, Nicolás Guerin,
Alejandro Oliva and Eduardo E. Paolini

Dpto. de Ing. Eléctrica y de Computadoras,
Universidad Nacional del Sur,
Avda. Alem 1253, B8000CPB Bahía Blanca, Argentina
mbdamico@criba.edu.ar

Abstract: The dynamical behavior of a buck converter operating in discontinuous conduction mode is studied in this paper. The aim is the detection of oscillations when the resistive load or the source voltage are varied, by using a frequency-domain approach for the analysis of period doubling bifurcations. The manuscript includes computational simulations and experimental results. *Copyright © 2007 CEA-IFAC.*

Keywords: converters, digital control, discrete-time systems, oscillations.