

## **Resúmenes en Inglés** *English Abstracts*

### **Networked-Control Based Systems. Modelling and Control Structures Design.**

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Abstract: This work focuses on a topic that lately is very active among control systems researchers and users. From Halevi & Ray (1988a,b) seminal papers until now, the interest for this kind of schemes that combine informatics nets with control theory has growing up continuously; nowadays it is quite common that scientific magazines and different congresses include specific contributions on this topic.

The orientation of this paper is to introduce widely these contents, in such a way that the Control Engineering practitioners can take a first contact with them. In this work they will find too an extensive references collection that allows to prepare in depth networked-based real-time control projects.

Some solutions have been proposed from control theory point of view; usually this type of systems are designed assuming teleinformatics techniques by means of optimal task or resources scheduling that implies specific protocols for quality of service and general performing improvement. Finally the authors proposed some original proposals based on non-conventional sampling (i.e. multirate and periodics) control systems methodology. Copyright © 2008 CEA.

Keywords: Networked-based Control Systems. Multirate. Field Bus. Delay. Event Control.

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### **An application of Fault Tolerance for the implementation of compensation Anti-Windup.**

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Abstract: In this contribution, a method for practical implementation of control systems with compensation of saturation is shown. The technique is applied in linear systems taking as a basis a fault diagnosis mechanism. To this end, the actuators saturation is considered as a fault in the control loop, which is detected and isolated by means of a Fault Diagnosis filters bank, whose residuals are used to make the compensation, providing a control scheme which is robust to this particular case. In order to obtain the filters gains, a  $H_2/H_\infty$  optimization problem with LMI constraints is used. To verify the properties of the proposed method, a numerical example is presented. Copyright © 2008 CEA.

Keywords: Fault Tolerant Control, Anti-Windup, Fault diagnosis Filters, Linear Matrix Inequalities.

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## **An alternative to regulate the Dc bus capacitors voltage from shunt active power filter based on 5-level cascaded inverter.**

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Abstract: An alternative to regulate the DC bus capacitors voltage from shunt active power filter is presented in this paper. The power stage of shunt active power filter is a cascaded five-level inverter. This multilevel converter has two H power cells in series connection and each power cell has a capacitive link. With only one voltage measurement from one power cell, the control law proposed has to regulate the two DC link voltages. To accomplish the DC bus regulation and the current output tracking, PIs controllers are used on each control loop. In order to demonstrate and validate the effectiveness proposed in this work several mathematical analyses, simulations and experimental results are shown. Copyright © 2008 CEA.

Keywords: Fault Active filter, Inverter, Harmonics, Reactive power, PI controller.

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## **Min-Max Model Predictive Control of a Pilot Plant.**

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Abstract: This work shows the application of a min-max model predictive control (MMMPC) strategy to a pilot plant in order to control the temperature of a reactor. An approximation of the worst case cost is used to compute the control action. This approximation allows us to compute a solution very close to that of the original min-max problem, but with a much lower computational burden. Due to its reduced complexity, it is easy to implement this strategy in real time for typical values of the prediction and control horizons. The behaviour of the process and the controller is illustrated by means of experimental results. Copyright © 2008 CEA.

Keywords: min-max model predictive control, additive uncertainty, pilot plant.

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## Study of 2-sliding Algorithms for Fuel Cells Control.

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Abstract: In this work, a comparative study of three different second order sliding mode algorithms is performed. These controllers are used to solve the breathing problem of a PEM fuel cell stack. The designed algorithms are validated by simulation using a complete system model, taking into account transient and robustness issues. Copyright © 2008 CEA.

Keywords: Fuel cells, nonlinear control, sliding mode.

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## Design of Quasi-Sliding Mode Observers via LMIs.

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Abstract: In this work a quasi-sliding mode robust observer for plants with nominal linear model and certain class of uncertainty/disturbance is presented. The output signals used for state estimation are corrupted with bounded noise. The design of the observer is formulated as an LMI (Linear Matrix Inequality) feasibility problem and bounds for estimation errors are obtained. These bounds can be calculated in advance. Subsequently, the design of the observer is improved as a GEVP (Generalized Eigen Value Problem) to minimize the bounds of the estimation errors. A numerical example with simulations of a single axis robotic arm driven by a DC motor is included at the end of the paper. Copyright © 2008 CEA.

Keywords: Observers, Nonlinear Systems, Sliding Mode Control, Invariance, LMI, Optimization.

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## On-line Clustering Method for Takagi-Sugeno Fuzzy Models Identification.

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Abstract: This paper presents a method for Takagi-Sugeno fuzzy modeling. This method updates on line both the structure and the parameters of the model by combining a new on line clustering algorithm with least squares techniques. The proposed clustering algorithm, that generates clusters that are used to form the fuzzy rule antecedents, is used for model structure identification. The update of consequent parameters is achieved by least squares estimators. Copyright © 2008 CEA.

Keywords: On line identification, Takagi-Sugeno fuzzy model, on line clustering, model adaptation.

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## Obtaining Interpretable Fuzzy Models of Dynamics Processes.

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Abstract: A novel methodology for constructing linguistically interpretable fuzzy models, from input and output data, of dynamics processes is presented. An easy clustering technique for constructing fuzzy rules and the application of least square means for adjusting consequent parameters is described. For the antecedent of each fuzzy rule, triangular membership function with overlap of 0.5 is used to guarantee the interpretability of the fuzzy model. The most promising aspect in our approach is the trade-off between a high accuracy and high interpretability. Furthermore, the use of another technique of artificial intelligence is not needed. Applications to well known data sets are presented: Box-Jenkins gas furnace, Mackey-Glass chaotic series and vertical motions of a scaled down of a helicopter. The results are weighed against those achieved by other methods. Copyright © 2008 CEA.

Keywords: identification, clustering, least mean square, fuzzy model, interpretability.

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