Resúmenes en Inglés
English Abstracts

Methodology for Obtaining Phenomenological Based Semiphysical Models applied to a Sugar Cane Sulfitation Tower.

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Abstract: This work presents the Phenomenological Based Semi-physical Model (PBSM) as a useful tool for the design, control and optimization of chemical and bio-technology processes. First, a detailed description of a methodology to obtain a PBSM based on the knowledge of the basic principles of the process: mass, energy and momentum conservation, as well as gradient principle for obtaining model constitutive equations. The described methodology is applied to the clarification stage of a sugar cane refining plant. Specifically, the sulfitation tower is modelled step by step. The model is simulated and validated by comparing its behaviour with data taken from a real sulfitation tower. Copyright © 2009 CEA.

Keywords: Sugar Device, Clarification, Sulfitation, Phenomenon based models.

A Modelling and Simulation of the Sugar Production Process.

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Abstract: In this paper a methodology for the development of dynamical mathematical model libraries for the sugar industry is shown. The library specifications and requirements make necessary the use of the Equations Based Object Oriented Modelling paradigm. Using a tool that complies with that paradigm a set of model libraries, containing the necessary components for building a complete sugar factory, have been developed. In this paper the most interesting constructive details of the sugar process libraries and some of the faced problems during its development are shown. The construction of the whole sugar factory is possible by connecting the different developed components by mean of the aggregation mechanisms provided by the used tool. The main contribution of the developed library, compared with other commercialized libraries, is the use of dynamic detailed models including malfunctions and anomalies. This feature provides a great versatility when using the library in applications like controllers design, training simulators or when the model is used as a source of data in online optimization process tools. Copyright © 2009 CEA.

Keywords: Continuous process modeling, Process simulation, Sugar Industry.

Simultaneous Design and Control of a Sugar Cane Sulfitation Tower.

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Abstract: This work focuses in the design and control of a plant used in the clarification stage of the sugar cane juice refining process. An innovative approach to the simultaneous design and control problem is presented, which considers the state controllability (based on practical controllability metrics) and the output controllability (based on dynamical performance indices) using as example the sulfitation tower. This statement translates into a non linear optimization problem where constraints are imposed over the plant operating conditions, the state controllability metrics and some closed loop performance indices while the investment, operating and control costs are minimized. The optimization problem was solved successfully using genetic algorithms. Copyright © 2009 CEA.

Keywords: Process design, Controllability, Process control. Optimization, Sulfitation tower.

Modeling and control of sugar cane crushing mill drove by electrical motors.

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Abstract: The extracting performance of juice from sugar cane crushing mill affects the profitability of sugar cane factories. The extraction process is done through a series of mills that separate the juice from the cane fiber. To maximize their extraction to a specified milling ratio is required to control the driver speed and the chute level. This article presents nonlinear dynamic model based in physical laws for sugar cane crushing mill drove by electrical motors and the design of control strategies and their performance evaluation. From experimental tests, the parameters are obtained and the models are validated. A cascade control strategy is proposed for the mill and it is performance is compared by simulation with rapport to control strategies found in industry via indices for extraction and reliability. The proposed strategies are compared in a case study via simulation with a real strategy. The analysis shows that the cascade control strategy of torque, angular speed and chute level reaches the best performance. Copyright © 2009 CEA.

Keywords: Sugar cane mills, Electric Drives, Modeling, Cascade Control.

Simulation of an algorithm for chute level control under discontinuous cane supply.

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Abstract: The current control methods for cane transport and preparation cause serious discontinuity problems in the cane supply to the milling train in Cuban sugar industry. The broad spread of frequency converters technology for speed control of induction motors allows proposing the usage of entry conveyors speed as the main control action to regulate the buffer chute height. This article presents an alternative control strategy by means of speed conveyors which considers the sugar cane height in the elevator conveyor as an input multiplicative disturbance. A sliding mode algorithm for set-point adaptation is proposed in order to delimit the chute level oscillations caused by the irregular cane supply. The proposed method only requires feedback of accessible variables and it is robust to cane density changes and measurement noise. Furthermore, its implementation is extremely easy for PID speed control loops. Copyright © 2009 CEA.

Keywords: Sugar cane mill, PID control, Speed control, Sliding control, Adaptive sep-point.

Adaptive Virtual Sensor of Ethanol Concentration for Industrial Reactors.

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Abstract: Control systems use sensors in the monitoring and control of process state. Sometimes, process variables are estimated because proper sensors are unavailable, they are prohibitively expensive or measurements are difficult to perform. One solution consists in to infer the state variables which are not measured from other variables by using virtual sensors or software sensors (soft-sensors). In alcoholic fermentation processes, measuring the ethanol concentration is essential. However, there are no cheap and reliable sensors capable of providing on-line measurements nor is there a global model for this variable which is accepted by everyone. In addition, two fermentations never are equal because microorganisms are very sensitive to small variables deviations. Therefore, these processes require an adaptive and robust estimating system. This paper presents an adaptive soft-sensor for a bioethanol fermentative process using an evolving fuzzy model. In addition, the obtained model is compact and it presents a suitable structure for future application in control strategies, in order to optimize the process productivity and to reduce production costs. Copyright © 2009 CEA.

Keywords: Bioethanol, fermentative processes, virtual sensor or software sensors, adaptive systems, fuzzy systems.

Online energy diagnosis of sugar plants.

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Abstract: This paper describes a software system for the energy diagnosis of sugar factories that has been developed in the Center of Sugar Technology (CTA, University of Valladolid, Spain). This tool takes data from the real process (control system and laboratory) and uses a stationary model (based in energy and mass balances), data reconciliation algorithms and optimization techniques to calculate non measured variables, eliminate errors in measured variables and obtain index of the energy efficiency. This software must be implemented in different factories. So, a set of tools has been developed to allow a fast configuration and code reuse. In particular, a library of stationary, modular and configurable models of sugar process units has been implemented in an Equation Based Object Oriented Modelling Tool, an adaptable SCADA with specific requirements and OPC communication tools has been developed. Copyright © 2009 CEA.

Keywords: linear Industrial applications of process control, Process modeling and identification, Real time optimization and control.

Electronic nose: State of art

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Abstract: This paper presents the artificial olfaction systems or electronic noses state of art , their operation and applications. Moreover, electronic olfaction concept and more representative applications are reviewed. Then the similarities between human olfaction and electronics devices are analyzed. Finally, the main concepts related with the use of electronic noses in autonomous robots and their applications are described. Copyright © 2009 CEA.

Keywords: Electronic nose, olfaction systems, pattern recognition, autonomous robots..

Conception, Development and Advances in the Navigation Control of Underwater Parallel Robots: the REMO-I Robot.

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Abstract: The REMO I is an underwater vehicle remotely operated (ROV). The main part of the robot is a parallel structure based on the Stewart - Gough platform. It allows to change its geometry to perform maneuvers with great flexibility of navigation and change the orientation and displacement using a single thruster on the back. Therefore, the robot can perform complex trajectories to reach place hidden in the water. This paper presents a brief description of the REMO-I mechanics, its control and instrumentation system. In addition the control architecture developed for the navigation and experimental are detailed. Copyright © 2009 CEA.

Keywords: Submarine rovers, Submarine robots, Parallel structure, Stewart-Gough platforms, ROV, UAV.

A model for the reliability analysis of Industrial Ethernet on ring topology.

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Abstract: Industrial Ethernet is been increasingly used for applications of automatization, either in manufacturing or processes industries. Besides the requirements of bandwidth, and real time traffic handling, these enviroments also present very strong requirements about reliability, due to the inherent risks of such activities. The ring topology is adequate for this type of networks, because it has a redundant connection that provides for a given fault tolerance. In the present work the reliability of Industrial Ethernet on ring topology is analyzed, with the aim to obtain useful results to the network design and selection of components, and also to allow to estimate the needed repairs. In the first step, the proposed model only considers the links, in order to analyze the reliability of the communication between switches. Later, the switches are included in order to analyze the reliability of the communication between field devices of through the network. The response time for the solution of a fault is one of the basic components of the considered model. Copyright © 2009 CEA.

Keywords: network reliability, network topologies, reliability analysis, mean time between failures (MTBF), fault tolerance.