Conference ICSTCC 2016

Invited Session: "Advanced Control for Real Time Applications"

Organizers: Dumitru POPESCU, Ciprian LUPU (University Politehnica of Bucharest, Faculty of Automatic Control and Computers, RO)

(dumitru.popescu@acse.pub.ro , ciprian.lupu@acse.pub.ro)

Description: The session offers a framework for presentations of research that bring interesting and relevant contributions in the field of real time applications, using advanced automatic concepts in the Energy Industry, Mechatronics, Petrochemical Industry, Aerospace, Transportation, Biomedicine and other areas of technical and economic interest.

Papers that will be appreciated, should offer modern solutions, related to the modeling, control and optimization of control systems structures, supported by an adequate theoretical background, implemented and validated on real-time operating configurations.

(Possible) Session structure:

1. **Robust adaptive control for real-time applications**
   Dumitru POPESCU, Pierre BORNE, Catalin DIMON, Catalin PETRESCU

In modern control applications, the digital systems design requires to solve two problems: identification of controlled object by a dynamic model and computation of numerical control algorithm, based on the estimated model. The work in simulation design ensures the nominal performances (NP) obtained on the nominal system (NS). Nonetheless, the main objective is to implement the nominal performances, as achieved performances (AP) on the real system (RS). Thus, the paper proposes new methods for improving nominal control through adaptive and robust strategies and introduces an aggregate adaptive-robust approach, which exploits simultaneously the qualities of adaptive and robust systems.

2. **Extremal Control for Photovoltaic Panels**
   Crina TOROUS, Chloe LOURDAIS, Genevieve DAUPHIN-TANGUY, Nicolaï CHRISTOV

The paper proposes an extremal polynomial control procedure, to improve the efficiency of photovoltaic panels (PP). The Maximum Power Point (MPP) of the panel is calculated using Coggin's algorithm and the Cauchy gradient algorithm. Starting from the dynamic model of the (PP), a numerical controller has been computed for the closed loop control system. A robustness analysis and correction has been performed for the RST polynomial algorithm, before the implementation on the photovoltaic panels. The achieved performances of the closed loop system are validated in simulation using the MATLAB / SIMULINK environment and the WinPim & WinReg dedicated software on photovoltaic tracking panels.

3. **Energy management of photovoltaic systems using fuel cells**

Cristian MIRON, Severus Constantin OLTEANU, Abdel AITOUCHE

Renewable energy systems present an accelerated growth both productions wise as well as in research fields. The energy obtained from photovoltaic panels and wind turbines has the disadvantage of a generated energy flux with an interrupted evolution. The classical solution is to create a network between photovoltaic farms spanning on large distances, in order to share the total energy before sending it to the clients. A recent proposed solution is to store the energy surplus using hydrogen. Fuel Cells (FCs) represent energy generators whose energy vector is usually hydrogen. These have already started the transition from the laboratory context towards commercialization. Due to their high energy density as well as their theoretical infinite storage capacity through hydrogen, FCs present themselves as high potential storage systems, not only for mobile applications, but also for stationary ones. Therefore a study on such distributed control systems is of an elevated importance. This paper analyzes existing solutions, with emphasis on a particular case.

4. Control and optimization of urban traffic by means of intelligent methods

Catalin DIMON, Genevieve DAUPHIN-TANGUY, Aziz NAKRACHI

The purpose of this paper is to propose a methodology of modeling and optimization for the field of road traffic control based on Bond Graph Theory. We consider a macroscopic approach based on the mechanism offered by generalized models for the representation of hydraulic systems. The model represents an urban area decomposed into simple interconnected elements. A general modular model for the area is constructed and a solution for efficient control of the input flow is proposed. The results are verified in simulation.

5. Consideration on real time implementation of fault/leak detection system in mass transfer networks

Ciprian LUPU, Doinita CHIRITA, Serban IFTIME

Leaks and faults detection in the energy fluids and utilities distribution networks represents an objective with significant implications; where, the safety of life and pollution are priorities included. Reality and scientific literature contains dedicated solutions, validated in time by theory and industry. Starting from a few of these, this paper proposes and analysis some applicative solutions based on the models identification, (mathematical) modeling and supervision of normal and fault operation in the transportation and distribution networks for (gas and liquid)utilities. Proposed supervisory structure is based on sensors/data acquisition and control architecture, associated on transportation and distribution network's SCADA system. The main purpose is to detect the fault situation as fast as possible and to indicate more accurate the affected area/point. The methods have been real time implemented, tested and validated with experimental laboratory facility.