Alberto Oliveri

Fixed-term assistant professor

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Education and training

2013
PhD in Electric Engineering
Automated Circuit Implementation of Embedded Control Systems and Virtual Sensors
University of Genoa - Genoa - IT

2009
Master degree in Electronic Engineering
Circuit synthesis of embedded control systems based on piecewise-affine techniques - 110/110 with honors
University of Genoa - Genoa - IT

2007
Bachelor degree in Electronic Engineering
Signal processing algorithms for limited resources digital architectures - 110/110 with honors
University of Genoa - Genoa - IT

Academic experience

2017 - ONGOING
Assistant professor
University of Genoa - Genoa - IT

2015 - 2017
Research fellow
University o Genoa - Genoa - IT

2013 - 2015
Post-doctoral fellowship
University of Genoa - Genoa - IT

Language skills

English
Independent

Teaching activity

- Elettrotecnica (cod. 66016), corso di Laurea in Ingegneria Chimica e di Processo, 60 hours
- Teoria dei circuiti (cod. 94975), corso di Laurea in Ingegneria Informatica, 60 hours

Postgraduate research and teaching activity

Postgraduate (PhD) teaching activity

'Advanced Programming in MATLAB and Simulink', for PhD in 'Scienze e Tecnologie per l'Ingegneria Elettrica, l'Ingegneria Navale, i Sistemi Complessi per la Mobilità', 20 hours.

Research interests

1. Circuit implementation of MPC control systems:
Model Predictive Control (MPC) is a model-based control technique for regulation of tracking of constrained systems, through the solution of an optimization problem at each sampling instant (implicit MPC). For linear or piecewise affine (PWA) systems, the optimization problem can be solved offline: an explicit formulation of the control law is therefore obtained as a function of the system state. This results being a PWA function defined over a polytopic partition (explicit MPC). My activity in this field is/was concerned with:

- FPGA or microcontroller implementation of explicit MPC controllers, for the regulation or tracking of linear, PWA and nonlinear constrained systems;
- design and circuit implementation of approximate MPC control systems, based on PWA functions defined over a simplicial (or hyper-rectangular) domain partition. This allows for a much more efficient circuit implementation;
- design and implementation of switched exact or approximate MPC control systems, for the regulation of PWA systems;
- application of MPC control systems for the transient stability in a power grid, the speed regulation of powertrain systems with backlash, the control of switch-mode power supplies, the tracking of vehicles with adaptive cruise control.

2. Circuits for indirect measurement of physical quantities (virtual sensors):
In many physical systems some quantities cannot be directly measured through real sensor, either because they are not accessible or because sensors are too expensive or inaccurate. In these cases, it is possible to estimate these quantities by measuring other correlated variables and applying a mathematical function.
My activity in this field is/was concerned with:

- design and circuit implementation of virtual sensors based on PWA

simplicial functions. These sensors are uniquely based on measurements and they do not rely on system models;
- application of virtual sensors for the estimation of the lateral velocity in a vehicle, the current in a one-kilometer cable subjected to radiations (in the Large Hadron Collider, at CERN, Geneve) and the Maximum Power Point (MPP) for the efficient management of photovoltaic plants.

3. Modeling and analysis of nonlinear systems:
My activity in this field is/was concerned with:

- modeling of nonlinear systems with hysteresis and creep (in particular, piezoelectric actuators and piezoresistive textiles) and development and microcontroller implementation of inverse models for the compensation of these phenomena;
- modeling and monitoring of ferrite-core inductors, operating in partial saturation within switch-mode power supplies (e.g., boost converters).

4. Development of software toolboxes:
I developed two MATLAB/Simulink toolboxes:

- MOBY-DIC Toolbox: for the automatic generation and simulation of embedded control systems based on explicit exact or approximate Model Predictive Control. Website: http://ncas.diten.unige.it/software/MOBY-DIC_Toolbox/index.shtml;
- HysTool: for the identification from experimental data and simulation of several hysteresis and creep models and the automatic generation of embedded compensators. Website: http://ncas.diten.unige.it/software/HysTool_Toolbox/.

Grants

2018 - ONGOING

Automatic methods to trade off performance and computing resources for controlled systems

Royal Society - GB
Participant

Editorial activity

Associate Editor for journal IEEE Transactions on Circuits and Systems - I (2018 - 2019)
Reviewer for the following journals: Sensors, IEEE Transactions on Circuits and Systems - I, IEEE Transactions on Industrial Informatics, IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, Advances in Mechanical Engineering, Control Engineering Practice, IEEE Transactions on Control System Technology.