NEW PERFORMANCE IMPROVEMENT TECHNIQUES OF CONTROL SYSTEMS USING EXPERIMENT-BASED TUNING

Goal of the project

Enhance the existing techniques and develop new techniques dedicated to the improvement of control system performance using experimental data

Short description of the project

The project aims:

- Enhancement and development of data-based (data-driven) techniques and algorithms for improving control system performances using experimental data.
- Enhancement and development of nature-inspired algorithms n optimization of control system performance.
- Development of optical character recognition (OCR) applications.
- Development of new fuzzy control solutions for a wide range of industrial processes

Project implemented by

Department of Automation and Applied Informatics

Implementation period

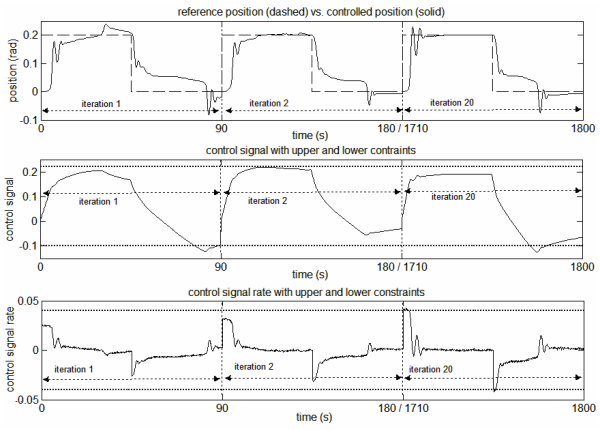
2011-2016

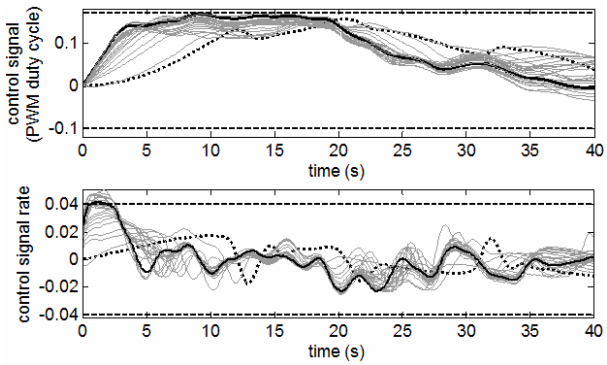
Main activities

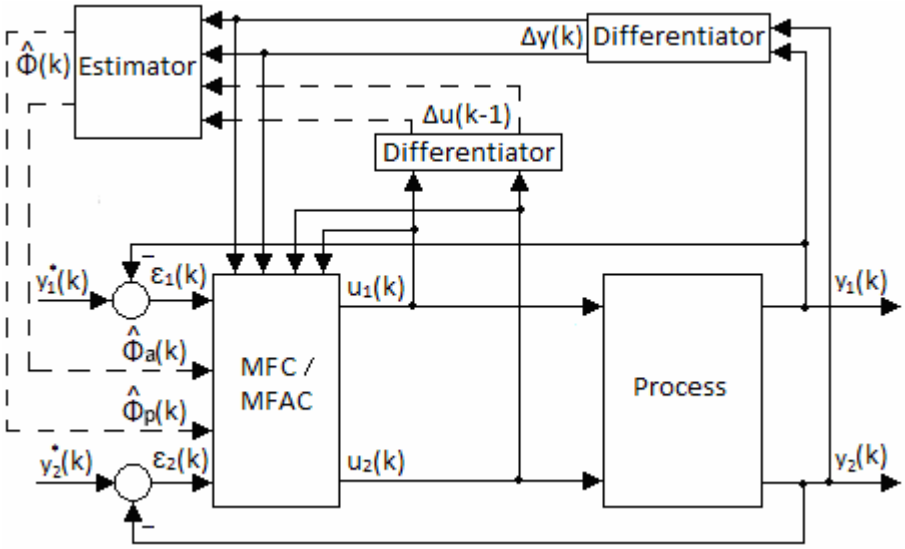
- Application of Iterative Feedback Tuning (IFT) to controller tuning for nonlinear control systems with constraints.
- Model-Free Adaptive Control strategies applied to multivariable (MIMO) aerodynamic systems.
- An experiment-based approach to Reference Trajectory Tracking optimal control problem with constraints.
- Validation of iterative techniques on laboratory equipment: liquid level control, motion control systems with motor actuation (speed and position control).
- Enhancement of control systems performance by fuzzy control, IFT and nature-inspired optimization algorithms (Charged System Search, Gravitational Search Algorithms).
- PI and fuzzy controller tuning to ensure a reduced sensitivity with respect to the parametric variations of processes.
- Enhancement of the training algorithm of Convolutional Neural Networks using a mixed approach of Back-Propagation and Gravitational Search Algorithm.

Results

- 7 papers published in Thomson Reuters Web of Science (formerly ISI Web of Knowledge) journals with impact factors in 2014.
- 7 papers published in conference proceedings and book chapters indexed in Thomson Reuters Web of Science (formerly ISI Web of Knowledge or ISI Proceedings) in 2014.
- 2 papers published in conference proceedings indexed in international databases (IEEE Xplore, INSPEC, Scopus) in 2014.
- 1 book chapter published in a Springer-Verlag volume.







Applicability and transferability of the results

Control systems with a reduced parametric sensitivity, tools for the computer-aided design of controllers, computer-aided techniques in iterative data-based control, nature-inspired optimization algorithms in control design and image processing, tools for the systematic development of fuzzy control systems.

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Research Centre

CCISA - Research Centre for Automatic Systems Engineering

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