LEARNING TECHNIQUES FOR IMPROVING CONTROL SYSTEMS PERFORMANCE USING MODEL-FREE APPROACHES

Goal of the project:

The main objective of this proposal is to develop the necessary tools, algorithms and theoretical framework in order to induce the learning-predictive behavior for control systems using model-free control approaches. Several reference input-controlled output behaviors are memorized as primitive tasks inside a library. The primitives are used in predicting the optimal behavior of the control system when a new complex task is to be executed. A planning mechanism similar to a brain will be built in order to achieve this task.

Short description of the project:

The proposed techniques endow control systems with learning and planning features.

Project implemented by

Department of Automation and Applied Informatics of Politehnica University of Timisoara
http://mbradac.info/te2015.html

Implementation period:

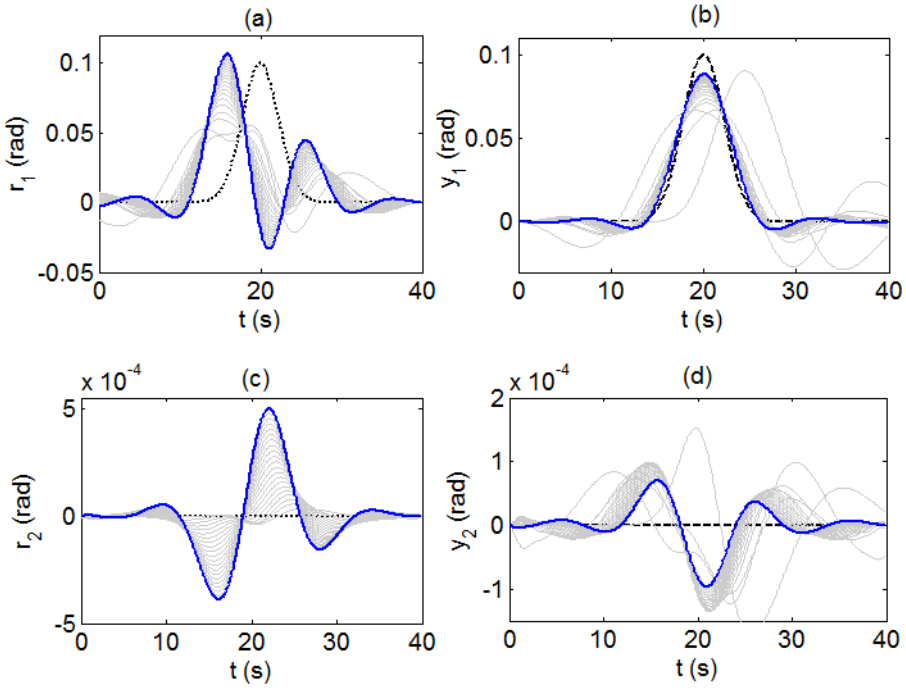
2015-2017

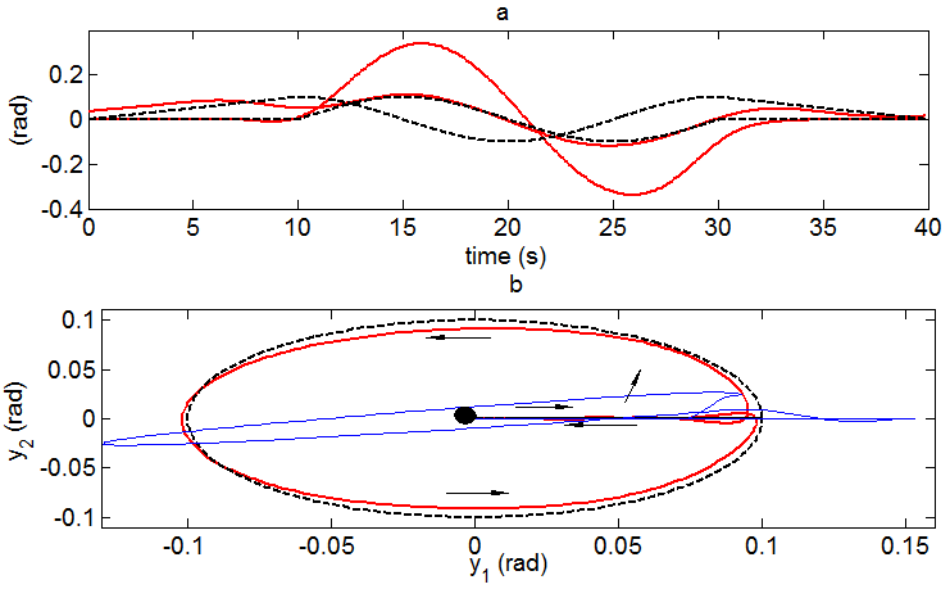
Main activities:

- Improvement of data-based (or data-driven) techniques and their combination for obtaining improved capabilities.
- Development and validation of a primitive-based learning and planning strategy for feedback control systems.
- Validation of the proposed theoretical approaches on real-world processes such as laboratory equipments.
- Dissemination of research results in highly visible journals and conferences.

Results:

- 4 papers published in Thomson Reuters Web of Science journals with impact factors;
- 8 papers published in conference proceedings (to be) indexed in international databases (ISI, IEEE Xplore, INSPEC, Scopus, DBLP);
- 1 book chapter published in a Springer-Verlag volume.





Applicability and transferability of the results:

Owing to the generality of the proposed theoretical framework, the primitive-based learning and planning approach for achieving optimal behavior can be applied to various (feedback) control systems such as mechanical, electrical, chemical, biological, or combinations of the above, in order to enhance them with optimal behavior ability in situations or scenarios never seen before. Thus, they imitate the living organisms. The results also connect several perspectives from the areas of feedback control and machine learning.

Financed through/by

Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI), Bucharest, Romania.

Research Center

Automatic Systems Engineering Research Centre (CCISA)
http://www.aut.upt.ro/centru-cercetare/index.EN.php

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