Postdoctoral Position
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Symbolic methods with adaptive control

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**Location:** LSV – ENS Cachan
CNRS – Univ. Paris-Saclay
Cachan, France

**Duration:** One year, starting early 2018

**Context and Objectives**

*Symbolic methods* in control theory use to first construct an *abstraction* of the model of the system under study, then synthesize a control in order to satisfy certain objectives. From the control synthesized at the abstract level is then derived a concrete control applying to the original model while fulfilling corresponding objectives.

Among the main abstraction methods, there are methods by *approximate bisimulation* [1, 2] and methods by *model reduction* [7]. Methods by approximate bisimulation construct an abstraction under the form of a discrete graph that results from discretization of the original real-valued state space. Model reduction (e.g., balanced truncation) reduce the order of the system under the assumption that the dimensions of the input and output vector are much smaller than the order itself [5].

Most of the work on symbolic control methods have focused on *static models* where the model parameters are time-invariant. In this project, we consider *dynamic models* with time-varying parameters. In order to treat such models, one has to design an *adaptive controller* that takes into account the evolution of the parameters. One can imagine two main kinds of adaptive control:

1. when the parameters values are moving slowly, one can construct *off-line* a set of abstract models for different ranges of parameters, and integrate an indicator setting when switching from a given range of parameters to another is necessary. Such a “supervisory controller” thus updates at discrete times the underlying abstract model [3, 9].

2. when the parameters are moving fast, it seems more convenient to measure/estimate the variations of the parameters *on-line*, and to adapt concurrently the current abstract model and the associated control [4, 10, 11].
This postdoctoral position is proposed within the project CODECSYS (Contract based design of cyber-physical systems) funded by the laboratory of excellence DigiCosme. The salary is XXXX euros net per month.

**Work description**

The postdoc researcher will have to:

1. establish a *methodology* for integrating adaptive controllers to symbolic methods according to the speed of evolution of the parameters, the number of parameters to be estimated, and the different types of quality that are sought for the control (precision, robustness, stability, cooperativeness...)

2. apply the methodology to various *large-scale case studies*: eg, delta wing [4, 6], hypersonic plane [6], bipedal robots [12], intelligent building [9].

**Background of the candidate**

The candidate must hold a PhD in computer science / control theory with a strong mathematical background. Strong programming skills are also needed.

Applications must include a cover letter, a detailed CV, the preprints of the two most significant publications, and two references who may be asked to provide letters of recommendation.

All documents should be sent in a single pdf file to the following email address: mailto:fribourg@lsv.fr

**References**


