WODES 2016,

13th Workshop on Discrete Event Systems,

Xi'an, China, May 30 - June 1, 2016

Special Session on

Invariance for the Performance Evaluation and Control of Discrete Event Systems

Session aim

The determination of positive invariant sets is a fundamental tool of systems and control theory. For discrete event systems as well, the concept of positive invariance was shown to be useful in many situations. The research on this topic is still very active, and the session aims to bring together the contributors on the field, to exchange their view, share their results and consider new directions. We briefly present hereafter four research directions that directly belong to the topics of interest to the session.

Performance evaluation

At a first level, the invariance concept is important for the **performance evaluation of dynamical system**. **Lyapunov stability** can indeed be reformulated in terms of invariant sets. The **determination of reachable sets** of systems subject to constraints also comes down to the computation of an invariant set. The determination of the reachable set of an automata or a Petri net also comes down to the computation of a set that can be characterized in terms of positive invariance for some operator. In the same way, the property of **observability** for automata, the stability of a timed event graph, certain **constraint satisfaction properties** for Petri nets, can all be studied via the computation of an invariant set.

Control, observation, robustness

At a second level, for systems with inputs or outputs, the concept of **controlled invariance**, and its dual concept of **conditional invariance**, extend the basic definition of positive invariance and appear to be fruitful for the **design of control laws and observers** of **dynamical systems subject to constraints or specifications**. The concept of **controllability** that is central in the supervisory control theory belongs to this family of generalized invariance properties. Another special invariance problem appears when two inputs are present in the system: controlled inputs and uncontrolled inputs, called disturbances in some problems. In some cases, the presence of uncertain parameters can also be taken into account, leading to the concept of **robust invariance**.

Systems over a semiring

The concept of invariance has been restated in many different frameworks, for various kinds of automata or Petri nets, including **continuous, hybrid or timed**

nets. All these systems can be seen as **systems other semirings**, for instance the semiring of **formal languages** over a given alphabet in the case of an automata, the **max-plus semiring** for a timed event graph, the **boolean algebra** for logical systems. The performance evaluation of such systems can often be expressed in term of invariance, as well as the synthesis of control law or a robust control law, that permits the controlled system to meet a set of given specifications, in spite of uncertain parameters or unknown inputs.

Algorithmic issues

Some families of invariant sets admit **supremal or infimal elements**, that can be exactly calculated as the **fixpoint of a set inclusion**, and provides optimal solution to control problems. In other cases, extremal elements do not exist, or their is no known algorithm for their computation. Sometimes it is useful to compute **upper or lower approximations**, for instance using **interval algorithms and contractions**. In many cases, the algorithms coming from invariant set computations are very efficient. In parallel, many algorithmic problems are the object of recent researches on the field.

Call for contributions

We seek contributions that make use of invariant sets to the solution of performance evaluation problems or control design problems, for various families of discrete event or hybrid systems.

Special session papers will follow the same schedule and reviewing process as regular papers. They must also be submitted through PaperCept following the link for invited session papers. When submitting a special session paper the authors should specify the session code that has been sent to them by the session organizers. Please contact the session organizer before the submission.

Session organizer
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Deadlines

Paper submission	January 21, 2016
Acceptance notification	March 15, 2016
Final submission	April 10, 2016
Date of Workshop	May 30 - June 1, 2016