Modeling the dynamic behavior of discrete deterministic dynamic systems

Luis Miguel Torres *

Joint work with: Annegret K. Wagler

Abstract

In this talk we present a model for the dynamics of discrete deterministic systems, based on an extension of the well-known Petri nets framework. Our model relies on the definition of a priority relation between conflicting transitions, which is encoded by orienting the edges of a transition conflict graph. We provide a characterization, in terms of a local consistency condition, of those deterministic systems whose dynamic behavior can be encoded using our approach. Moreover, given a dynamic system, we consider the problem of recognizing "valid" orientations of its transition conflict graph, i.e., those orientations that induce deterministic behaviors.

In a second part, the issue of reconstructing our model from experimental data obtained by observation of dynamic processes in the system is addressed. This is equivalent to inferring a valid orientation from knowledge about the directions of certain edges. For a special class of systems where the corresponding valid orientations are acyclic, we present a lower bound on the number of experiments required for model reconstruction and show that it is not possible to devise a solution strategy that achieves this bound for every instance.

*Escuela Politcnica Nacional, Quito, Ecuador