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Title Fault detection problems for Boolean control networks

Abstract :

The renewed interest in Boolean control networks (BCNs) can be credited to two major reasons. On the one hand, BCNs have proved to be a convenient modeling tool to capture a number of phenomena whose describing variables display only two operation levels (on/off, high/low, 1/0...). In particular, BCNs have been successfully employed to describe genetic regulation networks. On the other hand, the algebraic state representation for BCNs, developed by D. Cheng and co-authors, allows to cast BCNs into the framework of linear state-space models (operating on canonical vectors). This original set-up has opened new perspectives on the solution of many problems for this class of systems. In the talk we address the fault detection problem for BCNs. Specifically, we address the situation when, as a consequence of a fault, a BCN switches from its original model to a different one, thus generating output trajectories that are not compatible with the original updating equations and with the control input acting on the BCN. The main question we want to answer is the following one. Assuming that the BCN updating equations are known, but the state is not accessible, how can we decide whether a fault has occurred, by simply evaluating the BCN output corresponding to the applied control input? In order to answer this question, some preliminary fundamental aspects need to be investigated: what are the properties of the set of input/output trajectories generated by a BCN? Under what conditions is it possible to evaluate whether the input/output trajectories are legitimate for the BCN, by evaluating only their restrictions to time intervals of fixed length? When can the length of such time intervals be set a priori? What do we mean by a fault for a BCN and how do we model it?