Control of Asynchronous Dynamical Systems with Rate Constraints on Events

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In this paper we consider dynamical systems which are driven by events that occur asynchronously. It is assumed that the event rates are fixed, or at least they can be bounded on any time period of length T. Such systems are becoming increasingly important in control due to the very rapid advances in digital systems, communication systems, and data networks. Examples of such systems include control systems in which signals are transmitted over an asynchronous network; distributed control systems in which each subsystem has its own objective, sensors, resources and level of decision making; parallelized numerical algorithms in which the algorithm is separated into several local algorithms operating concurrently at different processors; and queuing networks. We present a Lyapunov-based theory for asynchronous dynamical systems and show how Lyapunov functions and controllers can be constructed for such systems by solving linear matrix inequality (LMI) and bilinear matrix inequality (BMI) problems. Examples are also presented to demonstrate the effectiveness of the approach.

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