

Abstract

Stability Analysis of Interconnected Dynamical Systems: Hybrid Systems Involving Operators and Difference Equations

We address the stability analysis of interconnected feedback systems, which consists of a linear interconnection of subsystems. Each subsystem is a feedback system, consisting of a local plant and a digital controller which is described by a system of difference equations and which includes A/D and D/A converters. We establish conditions for attractivity, asymptotic stability, asymptotic stability in the large, and boundedness of solutions for such systems. The hypotheses of our results are phrased in terms of the I/O properties of the local plant and in terms of the Lyapunov stability properties of the digital controller. In all cases, our results allow a stability analysis of complex interconnected systems in terms of the qualitative properties of the simpler free subsystems and in terms of the properties of the system interconnecting structure. The applicability of our results is illustrated by an example.