

Author:

Frédéric Mazenc (Inria Saclay, France)

Title:

New trajectory based approach for systems with delay: application to the reduction model technique

Abstract:

We propose a new technique for stability analysis for nonlinear dynamical systems with delays and possible discontinuities. In contrast with Lyapunov based approaches, our trajectory based approach involves verifying certain inequalities along solutions of auxiliary systems. It applies to a wide range of systems, notably time-varying systems with time-varying delay, ODE coupled with difference equations, and networked control systems with delay. It relies on the input-to-state stability notion, and yields input-to-state stability with respect to uncertainty. As an application of this technique, we solve a stabilization problem for linear continuous-time time-varying systems with bounded time-varying delays. We provide a novel reduction model approach that ensures global exponential stabilization of linear systems with a time-varying pointwise delay in the input, which allows the delay to be discontinuous and uncertain. Finally, we provide an alternative to the reduction model method, based on a different dynamic extension. Our main results use upper bounds on an integral average involving the delay.