
Strictifying storage functions for autonomous discrete-time systems using observers

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Résumé

This paper addresses the strictification of storage functions for autonomous discrete-time nonlinear systems. Given a storage function that does not increase along solutions, we present conditions under which we can construct an alternative storage function that strictly decreases along solutions. The results include, as a special case, the situation where one starts with a weak Lyapunov function and seeks to modify it into a strict Lyapunov function, thereby certifying properties stronger than mere stability. The approach relies on combining the original storage function with an auxiliary function derived from the assumed knowledge of an observer. We provide sufficient conditions for the existence of this auxiliary function and construct it for a class of smooth systems, as well as for general backward distinguishable nonlinear systems.

Mots-Clés: Lyapunov methods, Stability of nonlinear systems, Observers for nonlinear systems

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