Construction of Lyapunov Functions for Networks of iISS Systems: Small-Gain Criteria for Single Cycle, Bidirectional Cycle and General Graphs[*]

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Abstract: In this report, the problem of verifying stability of networks consisting of integral input-to-state stable (iISS) subsystems is addressed and a solution is presented. The iISS small-gain theorem developed recently has been restricted to interconnection of two subsystems. Recent nonlinear small-gain results on stability of large-scale systems have been successful only in dealing with input-to-state stable stable (ISS) subsystems. To address the stability problem involving iISS subsystems interconnected in general structure, this paper shows how to construct Lyapunov functions of the network by summing nonlinear transformations of individual iISS Lyapunov functions of subsystems.

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