Abstract

This thesis deals with stability analysis and stabilization of interconnected time-delay systems based on Lyapunov-Krasovskii approach and Linear Matrix Inequality formulation. It is well known that, in an interconnected system, time-delay naturally arises due to the time taken in transmitting information from one subsystem to another and such delays often lead to instability of the system. In addition to this, the feedback loop may also suffer from delays in sensing outputs and/or processing data that make design of a stabilizing controller more difficult. This thesis proposes a decentralized stabilization criterion for a general class of uncertain interconnected systems that have both the above types of delays. Moreover, the controller is so designed that it can even take care of nonlinearities present in the system. Numerical comparison of the present result vis-à-vis the existing ones for the special cases of the general system considered shows that the present one is superior.

Next problem considered is to design a decentralized adaptive controller for uncertain interconnected time-delay systems, which will be useful if the uncertainty bounds are unknown. Conditions for existence of adaptive controllers for the time-delay system with both *matched* and *unmatched* type uncertainties are investigated and a new type of adaptive controller is proposed that ensures ultimate boundedness of the system states as well as the adaptation parameters involved in estimating the unknown uncertainty bounds.

Lastly, the general problem of stability analysis of interconnected time-delay systems having both finite and arbitrary delays is investigated. A stability criterion is derived that gives benefit of utilizing the available delay information. This criterion is then used to derive a corresponding state-feedback stabilization criterion.

Key words: Interconnected systems, Decentralized control, Time-delay systems, Uncertain systems, Feedback delay, Adaptive control.