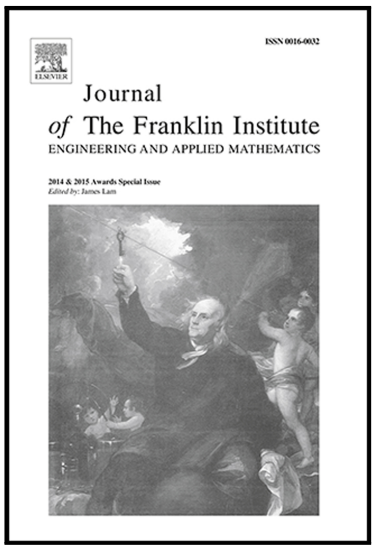

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Comparison of Bounding Methods for Stability Analysis of Systems with Time-varying Delays

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Abstract

Integral inequalities for quadratic functions play an important role in the derivation of delay-dependent stability criteria for linear time-delay systems. Based on the Jensen inequality, a reciprocally convex combination approach was introduced in [17] for deriving delay-dependent stability criterion, which achieves the same upper bound of the time-varying delay as the one on the use of the Moon et al.'s inequality. Recently, a new inequality called Wirtinger-based inequality that encompasses the Jensen inequality was proposed in [20] for the stability analysis of time-delay systems. In this paper, *it is revealed that the reciprocally convex combination approach is effective only with the use of Jensen inequality. When the Jensen inequality is replaced by Wirtinger-based inequality, the Moon et al.'s inequality together with convex analysis can lead to less conservative stability conditions than the reciprocally convex combination inequality.* Moreover, we prove that *the feasibility of an LMI condition derived by the Moon et al.'s inequality as well as convex analysis implies the feasibility of an LMI condition induced by the reciprocally convex combination inequality.* Finally, the efficiency of the methods is demonstrated by some numerical examples, even though the corresponding system with zero-delay as well as the system without the delayed term are not stable.

Keywords: Systems with time-varying delays, Jensen inequality, Wirtinger-based inequality, convex method, Lyapunov-Krasovskii functionals.

1 Introduction

During the last two decades, a considerable amount of attention has been paid to stability and control of linear systems with time-varying delays (see e.g., [2], [19] and the references therein).

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