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[2009-0951] Stability Analysis of Continuous-Time Iterative Learning Control Systems with Multiple State Delays

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摘要

关键词

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[2009-0951] Stability Analysis of Continuous-Time Iterative Learning Control Systems with Multiple State Delays

MENG De-Yuan, JIA Ying-Min, DU Jun-Ping, YU Fa-Shan

Abstract

This paper presents a stability analysis of the iterative learning control (ILC) problem for continuous-time systems with multiple state delays, especially when system parameters are subject to polytopic-type uncertainties. Using the two-dimensional (2-D) analysis approach to ILC, the continuous-discrete Roesser's type linear systems are employed to describe the entire learning dynamics of time-delay systems (TDS) with the development of an expanding operator. Based on such Roesser systems, the 2-D system theory is first used to develop a necessary and sufficient condition for the asymptotic stability of ILC, and then the robust H_{∞} control theory is combined to provide a sufficient condition in terms of linear matrix inequalities (LMIs) for the monotonic convergence of ILC. It shows that learning gains can be determined by solving LMIs, which ensure the control input error converging monotonically to zero as a function of iteration. Simulation results show that a robust asymptotically stable ILC scheme can become robust monotonically convergent by adding the P-type learning gains that satisfy a set of LMIs, which can also improve the convergence rate greatly.

Key words

Iterative learning control time-delay systems monotonic convergence 2-D system theory robust H∞ control theory linear matrix inequality

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通讯作者

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