论文与报告

基于多面体终端域的Hammerstein-Wiener非线性预测控制

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摘要
许多实际系统都可以表示成一种中间为线性动态子系统、输入输出端为非线性静态子系统的Hammerstein-Wiener型非线性模型. 针对输入和输出受约束的Hammerstein-Wiener型非线性系统, 提出一种基于多面体终端域的预测控制综合算法. 离线设计时, 通过构造一系列多面体不变集, 扩大了终端域; 在多面体不变集内, 设计非线性控制律, 减少了常规线性控制律设计的保守性. 在线计算时, 通过求解有限个线性矩阵不等式(Linear matrix inequalities, LMIs)优化问题, 不仅可以满足实时性要求, 而且能够改善控制性能. 仿真结果表明了采用多面体不变集的优越性.

关键词　Hammerstein-Wiener非线性模型　模型预测控制　多面体终端域　稳定性　线性矩阵不等式

分类号

Predictive Control of Hammerstein-Wiener Nonlinearity Based on Polytopic Terminal Region

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Abstract
Many actual systems are often represented as the Hammerstein-Wiener nonlinear models, where a linear dynamic subsystem is surrounded by two static nonlinear subsystems at its input and output. For Hammerstein-Wiener nonlinear systems with the input and output constraints, a predictive control synthesis algorithm based on polytopic terminal region is proposed. At the offline stage, by constructing a series of the polytopic invariant sets, the terminal region is enlarged; in the polytopic invariant set, the nonlinear controller is designed, then the conservation of conventional linear control law design is reduced. At the online stage, by solving a finite number of linear matrix inequality optimization problems, not only the real-time demand can be satisfied, but also the control performance can be improved. Simulation results show the advantages of adopting polyhedron invariant set.

Key words　Hammerstein-Wiener nonlinear models　model predictive control (MPC)　polytopic terminal region　stability　linear matrix inequalities (LMIs)

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