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基于容许集的变终端约束MPC控制

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Efficient varying terminal constraint set MPC based on admissible set

摘要

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摘要

针对一类输入和状态受约束的离散线性系统,提出一种基于N步容许集的变终端约束集模型预测控制方法.首先给出多面体不变集序列作为终端约束集的离线模型预测控制算法,扩大了终端约束集.为进一步扩大初始状态可镇定区域,引入N步容许集,设计了基于容许集的变终端约束集模型预测控制方法.该算法采用离线设计、在线优化方法,实现了系统渐近稳定,不仅降低了在线运算量,而且扩大了初始状态可镇定区域.仿真结果表明了算法的有效性.

关键词: 约束离散系统, N步容许集, 多面体不变集, 模型预测控制

Abstract:

An efficient model predictive controller(MPC) with a time varying terminal constraint set based on N-step admissible set is developed for a discrete-time linear system with input and state constraints. Firstly, off-line MPC is designed for an LTI system with input and state constraints by constructing a continuum of polytopic invariant sets. The terminal constraint set is constructed by the union of these polytopic invariant sets, so this method enlarges the size of terminal constraint set effectively. In order to enlarge the size of allowable set of initial conditions, a synthesis approach of on-line and off-line MPC with N-step admissible set is presented. This algorithm not only dramatically reduces on-line computation but also significantly enlarges the size of the allowable set of initial conditions. The digital simulation results show the effectiveness of the proposed method.

Key words: Constrained discrete-time system, N-step admissible set, Polytopic invariant set, Model predictive control

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