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过程系统工程

参数不确定非线性系统切换控制

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摘要 针对一类含有不确定参数的非线性系统，基于其参数的不确定范围，设计多个滑模变结构控制器。在此基础上，基于一给定的指标切换函数构造切换控制器。在确保系统Lyapunov稳定性的前提下，被控对象的控制器按照预先设定好的切换条件，在多个控制器之间相互切换，从而极大地改善系统的瞬态响应。以工业机器人手臂为研究对象，针对机器人手臂运动方程构造滑模变结构控制器，并设计以输出误差为自变量的指标切换函数，基于此切换函数构造切换控制器，使机械手的控制器在多个控制器之间进行切换。针对不同的参数变化范围，研究切换控制的有效性。多个仿真实例表明切换控制能极大地改善控制品质。

关键词

非线性系统 滑模 变结构 切换

分类号

Switching control of nonlinear system with uncertain parameters

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Abstract

Based on the scope of change of parameters，multiple sliding mode variable structure controllers were designed for a kind of nonlinear system with uncertain parameters. A switching controller was formed with a given index switching function. Under the guarantee of Lyapunov stability，the controller of system would be switched among multiple sliding mode variable structure controllers according to the switching condition. The mechanism of switching could improve the transient response greatly. A robotic arm was studied as a nonlinear system. Multiple sliding mode variable structure controllers were set up according to the dynamic equation of the robotic arm. An index switching function based on output error was given for the design of switching controller of the robotic arm. To test the effectiveness of the switching controller，four simulation examples according to different scopes of parameter change were investigated. From the simulation，it was concluded that the switching controller could enhance the control performance greatly.

Key words

nonlinear system sliding mode variable structure switching

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