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制导、导航与控制

空间电磁对接轨迹跟踪的自适应控制

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摘要：

面向在轨服务的空间电磁对接技术能克服传统基于推力器对接所固有的不足，应用前景广阔。航天器对接是一个相对距离逐渐减小的过程，应用于控制器设计的解析远场电磁力模型具有强非线性，且模型误差随相对距离的减小而逐渐增大。基于Lyapunov稳定性理论开展空间电磁对接轨迹跟踪控制器的自适应设计，通过控制参数在线修正以消除模型的不确定性以及外界干扰的影响；开展控制参数整定分析，证明了自适应控制策略的渐近稳定性。理论分析及仿真结果表明,空间电磁对接的自适应控制策略是可行的，并且具有渐近稳定性。

关键词： 空间电磁对接 轨迹跟踪 Lyapunov稳定 自适应控制 渐近稳定性

Adaptive control of trajectory tracking for space electromagnetic docking

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Abstract:

he electromagnetic docking technology for on orbit servicing mission can avoid inherent challenges with the traditional thruster, having favorable applications. Spacecraft docking is a process with which relative distance between the two satellites gradually decreases. So, the far field model of electromagnetic force using for controller design not only has strong nonlinearity, but also has gradually increasing model error in the docking process. Based on the Lyapunov’s stability theory, an adaptive controller of trajectory tracking for space electromagnetic docking is designed,then the uncertainty of the model and the effect of the external disturbance are eliminated by the way of on line varying of model parameters| the controller’s parameters are tuned and the asymptotic stability of the adaptive controller is also proved. Academic analysis and simulation results indicate that the adaptive control law is feasible and has asymptotic stability.

Keywords: space electromagnetic docking trajectory tracking Lyapunov stability adaptive control asymptotic stability

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