

控制理论与实践

基于二阶滑模的BTT导弹反演滑模控制

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摘要:

针对具有非匹配不确定性的倾斜转弯(bank-to-turn, BTT)导弹非线性动力学模型, 基于反演思想和二阶终端滑模控制方法, 设计了一种新的BTT导弹反演滑模控制器。反演设计的每一步均采用滑模控制对不确定性进行补偿, 并在最后一步设计中采用非奇异二阶终端滑模控制, 既能防止抖振对舵机造成损坏, 又减小了累积误差。采用精确微分器解决“计算膨胀”问题, 并证明了跟踪误差最终有界。仿真结果表明, 通过适当选取设计参数, 跟踪误差将收敛到原点附近任意小的邻域内。

关键词: 倾斜转弯导弹 反演控制 二阶滑模控制 终端滑模 非奇异

Backstepping sliding mode control for BTT missiles based on second-order sliding mode

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Abstract:

Based on backstepping design and second-order sliding mode control, a new backstepping sliding mode controller is designed for bank-to-turn (BTT) missiles nonlinear dynamics with unmatched uncertainties. Sliding mode control is used in each step of the backstepping design to compensate for uncertainty, and nonsingular second-order sliding mode control is used in the last step of the backstepping design. In this way, the chattering problem which does harm to rudders can be avoided, meanwhile, the accumulated error is reduced. Computation explosion is reduced by introducing an exact robust differentiator, and the tracking error of the system is proved ultimately bounded. Simulation result shows that the tracking errors converge to an arbitrary small neighborhood of the origin by adjusting the design parameters of the controller.

Keywords: bank-to-turn(BTT) missile backstepping control second-order sliding mode control terminal sliding mode nonsingular

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