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制导、导航与控制

考虑导弹自动驾驶仪二阶动态特性的导引律

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摘要:

基于平面内目标-导弹相对运动方程,考虑导弹自动驾驶仪的二阶动态特性,应用动态面控制方法设计了一种新型导引律。在设计过程中,通过引入一阶低通滤波器,使得导引律的最终表达式中不含视线角速率的高阶导数,更易于实际应用。该导引律有效地克服了导弹控制系统的动态延迟对制导精度的影响。将该导引规律与未考虑导弹自动驾驶仪动态的自适应滑模导引律相比较,对目标非机动、阶跃机动和正弦机动三种情况进行仿真。仿真结果表明,在目标机动加速度快速变化,而且导弹自动驾驶仪存在较大滞后情况下,这种导引律仍具有很高的制导精度。

关键词: 导引律 动态面控制 自动驾驶仪 二阶动态特性

Guidance law incorporating second-order dynamics of missile autopilots

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Abstract:

Based on the target-missile dynamics in plane and the second-order dynamics of missile autopilots, a new guidance law is designed using the dynamic surface control method. Some first-order low-pass filters are introduced into the design process to avoid the occurrence of high-order derivatives of line of the sight angular rate in the expression of the guidance law. Thus, the guidance law is easy to implement in practical applications. The proposed guidance law is effective in compensating the bad influence of the autopilot lag on guidance accuracy. In simulations of intercepting non maneuvering targets, targets with step acceleration, and targets with sinusoidal acceleration respectively, the guidance law is compared with the adaptive sliding mode guidance law which does not incorporate the dynamics of missile autopilots. Simulation results show that the guidance law still ensures an exact guidance result, even if the target escapes in a great and fast maneuver and the autopilot has a relatively large lag.

Keywords: guidance law dynamic surface control autopilot second-order dynamics

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