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具有碰撞角约束的三维圆轨迹制导律

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Three-dimensional Circular Guidance Law with Impact Angle Constraints

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摘要 针对再入飞行器带碰撞角约束的导引问题,设计了一种新型三维(3D)制导律。改进并扩展了圆轨迹导引算法,定义了2个圆轨迹跟踪误差变量。通过对导引任务的分析,提出闭环修正导引方法。在此基础上,对再入飞行器制导过程的动力学方程进行解析推导,设计出能适应再入飞行器速度大小变化的三维闭环圆轨迹制导律(3CCGL)。数学仿真结果表明:此制导律能导引再入飞行器沿终端约束方向精确命中目标;同已有算法相比,该制导算法优势明显,其导引的飞行路径短,终端碰撞速度大,并能实现大角度转向攻击,大幅提高再入飞行器的末段机动能力。

关键词: 再入 制导律 三维空间 圆轨迹导引 碰撞角约束 闭环修正

Abstract: A novel three-dimensional (3D) guidance law is proposed for a reentry vehicle with impact angle constraints. To make the circular guidance more applicable, two deviation variables are defined. Then a closed-loop modification method is presented for the mission. Furthermore, a 3D closed-loop circular guidance law (3CCGL) for varying velocities is derived by solving the dynamical equations of the reentry vehicle. The simulation results demonstrate that the 3CCGL can assure the reentry vehicle to impact the target accurately from a specified direction. Compared with another law from the literature, the proposed guidance law is shown to perform favorably with shorter path length, larger terminal velocity and great improvement in the terminal maneuverability of the reentry vehicle in a large-angle turning engagement scenario.

Keywords: reentry guidance law 3D space circular navigation impact angle constraints closed-loop modification

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