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带太阳帆板航天器刚柔耦合动力学研究

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Research on Rigid-Flexible Coupling Dynamics of Spacecraft with Solar Panel

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摘要 以带有太阳帆板的航天器为研究对象,计及太阳帆板变形位移场的非线性耦合项,采用假设模态离散变形,基于Kane方程建立起系统的刚柔耦合一次近似动力学模型。分别就大范围刚体运动已知和未知两种情况下进行了数值仿真。仿真结果说明,此模型能准确的预示大范围运动下挠性航天器的动力学行为,而传统的零次近似动力学模型由于丢失了动力刚度项而会得到错误结论。

关键词： 刚柔耦合 动力刚化 假设模态 数值仿真 Kane方程

Abstract： The rigid-flexible dynamics of spacecraft with solar panel is investigated in this paper. Different from the traditional modeling method which loses the dynamic stiffness terms, the present modeling method that employs the nonlinear coupling terms of the elastic deformed displacement can capture the dynamic stiffness terms. The modal assumption method and Kane's methods are employed in order to derive the first order approximate dynamic equations. The results of numerical simulation show that, the present modeling method provides not only the accurate simulation results but also the limit of validity of the traditional modeling method.

Keywords： rigid-flexible coupling dynamic stiffening modal assumption numerical simulation Kane equations

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