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### 轻型高精度卫星的变结构姿态控制器

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#### VARIABLE STRUCTURE CONTROLLER OF SMALL SATELLITE FINE ATTITUDE

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摘要

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**摘要** 针对某些小卫星高指向精度和高稳定精度的姿态控制要求,设计了能克服反作用轮转速过零扰动的变结构姿态控制器,并对反作用轮转速过零时低速摩擦对卫星姿态产生扰动的机理进行了分析,建立了仿真用反作用轮低速摩擦动力学模型。同PID控制器相比,该变结构姿态控制器能有效抑制反作用轮的低速摩擦影响,并具有良好的鲁棒性。数学仿真进一步证明了该变结构姿态控制器的有效性,其指向精度和稳定精度分别可达0.3°和0.001°/s

**关键词:** 小卫星姿态控制 反作用轮低速摩擦 变结构控制

**Abstract:** In this paper, a small satellite fine attitude control system is analyzed and designed. This attitude control system consists of 3 orthogonal reaction wheels, whose low speed friction disturbs small satellites attitude pointing accuracy and stabilization. A mathematical model of the low speed friction used in simulation is presented in this paper, and a variable structure attitude controller is designed to suppress this disturbance. Independent of the friction model, the variable structure controller avoids the difficulty to get an accuracy model, and is more robust. Furthermore, compared with PID controller, it resolves the disturbance of the low speed friction to attitude, and greatly improves small satellites attitude pointing accuracy and stability. Finally, the simulation results prove that the variable structure controller can provide the pointing accuracy of 0.3° and the stability of 0.001°/s.

**Keywords:** small satellite attitude control reaction wheels low-speed friction variable-structure control

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