

弯扭耦合柔性构件系统的变结构控制研究 Variable Structure Control Coupled Bending-torsional Flexible Structure System

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关键词: 柔性构件 耦合振动 致动器 滑模变结构控制

摘要: 对由柔性杆和柔性梁组成的两连杆柔性构件系统的弯扭耦合振动进行了研究, 建立了此柔性系统的动力学方程。在柔性杆根部粘贴一只压电扭转致动器抑制柔性杆的扭转振动, 在柔性梁根部粘贴一只压电弯曲致动器抑制柔性梁的弯曲振动。采用一种带有饱和环节及滤波器的滑模变结构控制策略, 进行了实验研究。结果表明: 施控后的系统是稳定的, 弯扭的各阶模态均能得到有效抑制, 柔性梁末端的振动位移能得到显著衰减。 A two-link flexible structure system consisting of a flexible bar and a flexible beam was proposed. The coupled bending-torsional vibration of the flexible structure system was investigated. The dynamic equation of the system was established. A piezoelectric torsional actuator was bonded onto the root of a flexible bar to suppress the torsional vibration of the flexible bar, and a piezoelectric bending actuator was bonded onto the root of the flexible beam to suppress the bending vibration of flexible beam. Experimental research was performed using a sliding mode variable structure control strategy with a saturation unit and a filter. The results show that the controlled system is stable, all the bending and torsional modes are effectively suppressed and the tip vibration of the flexible beam is dramatically attenuated.

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