

考虑摩擦和间隙影响的机床进给伺服系统建模与分析 Modeling and Analysis of Machine Tool Feed Servo Systems with Friction and Backlash

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关键词: 机床 进给伺服系统 摩擦 间隙 爬行 模型

摘要: 进给伺服系统的性能对数控机床的跟踪及定位精度、加工质量等有着重要的作用。摩擦和间隙的非线性会导致系统的爬行、振荡等不稳定行为。针对闭环控制的直联式进给伺服系统,建立了考虑摩擦和间隙的综合力学模型和数学模型。研究了低速进给条件下摩擦和间隙非线性对工作台输出的影响,得出了工作台产生爬行现象的几种可能条件,并给出消除进给系统爬行现象的几种常见措施。所得结论为进给伺服系统的优化设计和性能预测提供了理论支持。 The performance of the feed servo system has an important effect on CNC machine tools, including the tracking and position accuracy as well as the surface quality of the machined part. The nonlinear factors such as friction and backlash can induce unstable behaviors such as stick-slip and oscillation of the feed servo system. The mechanical and mathematical models containing friction and backlash were established for the motor direct-connected feed servo system with close loop controller. The effects of friction and backlash on the worktable under low feeding velocity were studied. A few of possible conditions for the stick-slip occurrence of the worktable were obtained. And some means for cancelling the stick-slip behavior of the feed servo system were presented at last. The research results provided a theoretical support for the optimum design and performance forecast of the feed servo system.

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