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直升机/发动机系统综合控制半物理仿真

Semi-physical simulation on integrated helicopter/engine control system

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英文关键词:integrated helicopter/engine system controlx semi-physical simulation test cascade proportional integration differential (PID) control torque feed forward

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中文摘要：

基于直升机/发动机系统综合控制半物理仿真试验平台,针对直升机/发动机系统综合模型和综合控制算法进行数字与半物理仿真试验研究.提出了一种串级PID(proportional integration differential)+扭矩前馈+总距补偿的系统抗扰控制算法,并提出了基于机载简化发动机模型的多模式综合实时优化控制算法.试验结果表明:所建立的 直升机/发动机系统综合开闭环模型能够模拟发动机从起动到慢车再到直升机飞行的整个过程,自由涡轮转速超调量和下垂量均在4%以内,在不同飞行条件下,动静态品质均满足设计要求.本文还进行了综合系统多模式优化技术的半物理仿真,结果表明所设计综合控制律的良好工程应用前景.

英文摘要：

Based on the simulation platform of integrated helicopter/engine system control,semi-physical simulations were carried out for integrated helicopter/engine model and integrated control algorithm.The core part of anti-disturbance control of the integrated system adopted a novel algorithm of cascade proportional integration differential(PID)+torque feed forward+collective compensation,and the optimization control was multi-mode real-time optimization based on the simplified engine adaptive system model.The simulation tests show that the established integrated helicopter/engine model can simulate the engine's total process from start to idling,then to helicopter flying,and the droop and overshoot of the power turbine is within 4% in the whole process.The engine's dynamic and static quality meets the requirements of helicopter flight control in different flight conditions.The semi-physical simulation results of the integrated system multi-mode optimization were validated.The established semi-physical simulation platform of integrated helicopter/engine control system is valuable for engineering applications.