

自动化

水轮机调速系统的H ∞ 双回路鲁棒控制策略

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摘要:

建立了考虑水电站引水系统水锤效应的弹性水体水轮机模型, 并据此构建了水轮机调速系统模型。针对水轮机调速系统具有参数不确定性、存在干扰等特点, 运用H ∞ 鲁棒控制理论, 提出了水轮机调速系统H ∞ 双回路鲁棒控制策略, 以水门开度偏差为补偿信号构建了内环反馈回路, 以发电机转速偏差为补偿信号构建了外环反馈回路。仿真结果验证了该控制策略的有效性, 而且其时域性能指标明显优于传统比例-微分-积分(proportional integral derivative, PID)调节器控制效果。

关键词: 水轮机调速系统 水锤效应 H ∞ 双回路 弹性水体

An H ∞ Double-Loop Robust Control of Hydro Turbine Speed Governor

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Abstract:

A hydro turbine model, in which the water hammer effect of elastic water column in diversion tunnel of hydropower station is taken into account, is built, and on this basis a governor system model of hydro turbine is constructed. According to such features of hydro turbine governor system as uncertainty of parameters and existence of disturbances, by use of H ∞ robust control theory a double-circuit robust control strategy for hydro turbine speed control system is proposed. Taking the deviation signal of gate opening as compensation signal, the inner feedback loop is constructed; and taking the rotating speed deviation of hydraulic generator as compensation signal, the outer feedback loop is constructed. The effectiveness of the proposed control strategy is verified by simulation results and it is also proved that the time-domain performance indices of the proposed control strategy are evidently better than those of governor controlled by traditional proportional integral derivative (PID) regulator. Simulation results of system load and system disturbance show that the proposed H ∞ double loop robust controller possesses excellent robustness under parameter perturbation and norm-bounded disturbance.

Keywords: hydro turbine speed governor system effect of water hammer H ∞ double loop elastic water column

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