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可逆冷带轧机速度张力系统的耗散Hamilton 控制

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Dissipative Hamilton control for speed and tension system of reversible cold strip rolling mill

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摘要

研究基于侵入与不变流形(I&I) 自适应方法和非线性干扰观测器(NDO) 的可逆冷带轧机速度张力系统耗散Hamilton 控制问题. 首先采用I&I 自适应方法估计系统的摄动参数; 其次, 通过预反馈建立系统速度张力外环的耗散Hamilton 模型, 并利用互联和阻尼配置以及能量整形方法设计耗散Hamilton 控制器; 再次, 选用NDO对系统电流内环的外扰进行观测, 并引入设计的积分滑模控制器中进行补偿; 最后将该方法应用于某1 422mm可逆冷带轧机速度张力系统中进行仿真, 结果验证了所提出方法的有效性.

关键词 ： 可逆冷带轧机, 速度张力系统, 协调控制, 非线性干扰观测器, 侵入与不变流形, 耗散Hamilton控制

Abstract :

Dissipative Hamilton control problem for the speed and tension system of the reversible cold strip rolling mill is studied based on the immersion and invariance(I&I) adaptive method and the nonlinear disturbance observer(NDO). Firstly, the I&I adaptive method is used to estimate the perturbation parameters of the system. Next, the dissipative Hamilton model of the speed and tension outside loop is built after pre-feedback control, and dissipative Hamilton controllers are designed by utilizing the interconnection and damping assignment, and energy shaping method. Further more, external disturbances in the system current inside loop are observed by NDOs, and the observed values are introduced into the integral sliding mode controllers for compensation. Finally, a simulation is carried out on the speed and tension system of a 1422 mm reversible cold strip rolling mill, and results show the effectiveness of the proposed control strategy.

Key words : reversible cold strip rolling mill speed and tension system coordination control nonlinear disturbance observer immersion and invariance dissipative Hamilton control

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