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线性系统的输出反馈次优扰动抑制:内模原理方法

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Output feedback suboptimal disturbance rejection for linear systems:internal-model principle method

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摘要 运用内模原理研究线性系统的输出反馈扰动抑制问题.首先根据扰动的动态特性构造内模系统,将最优扰动抑制问题转化为等价的最优调节问题.然后通过构造降维状态观测器重构输出反馈中测量不到的部分状态变量;通过求解一组矩阵微分方程或矩阵方程得到次优控制律,利用控制律中的内模补偿项与外部扰动进行对消.最后采用海洋平台简化模型作仿真示例,将所设计的扰动抑制控制器与前馈反馈最优扰动抑制控制器作比较,证明所设计的控制器能够实现无静差的扰动抑制.

关键词: 输出反馈 内模原理 扰动抑制 最优控制 观测器

Abstract: The paper considered the output feedback disturbance rejection problem based on internal-model principle for linear systems.According to the disturbance dynamics,the internal model was constructed.The optimal disturbance rejection problem was transformed into an equivalent optimal regulation problem for the augmented system.Then,a reduced-order state observer was constructed to reconstruct the unmeasurable state variables from the output feedback.The suboptimal control law was derived from series matrix differential equations or matrix equations,in which the disturbance was eliminated by the internal-model compensator.Finally,a simplified offshore platform system was applied for simulation example.Comparing with the feedforward and feedback optimal disturbance rejection control law,the designed controller was validated to be able to reject disturbance without steady-state error.

Key words: output feedback internal-model principle disturbance rejection optimal control observer

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