

短文与研究通讯

信道噪声对无线远程迭代学习控制系统的影响

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摘要:

无线远程控制系统的特征是信号通过无线网络在传感器与控制器, 控制器与执行器之间传输, 但信号无线传输过程中受到的信道噪声干扰会严重影响系统的控制性能。针对一类控制器采用迭代学习控制方式的无线远程控制系统, 首先得到系统输出误差和信道噪声在迭代域内的关系表达式, 然后在此基础上就信道噪声对输出误差信号范数平方期望收敛性能的影响进行分析。由分析可知, 该期望是关于信道噪声方差和系统参数的函数, 并将随迭代次数的增加收敛于一个有限的误差值。在系统参数一定的情况下, 该误差值将随信道噪声方差的增大而增大, 即信道噪声方差越大, 其对系统跟踪性能的影响越明显。最后, 通过仿真实验证明了分析结果的正确性。

关键词: 无线远程控制; 迭代学习控制; 信道噪声;  $l_2$  范数

Influence of Channel Noises on Wireless Remote Iterative Learning Control Systems

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Abstract:

In wireless remote control systems, one feature is that signals are transmitted in wireless network from the sensor to the controller and from the controller to the actuator, but signals are inevitably disturbed by channel noises, which affect the performance of wireless remote control systems seriously. For a class of wireless remote control systems with iterative learning control (ILC) method in the controller, the relation of channel noises and output error is derived first, and then the influence of channel noises on the expectation of squared  $l_2$ -norm of output error is analyzed. The analysis shows that the expectation is a function of system parameters and channel noise variances, and converges to a limit error with the increase of iteration number. When system parameters are fixed, the value of the limit error increases with the increase of channel noise variances, which means the larger channel noise variances are; the greater the influence on the tracking performance is. Finally, simulation experiments are presented to demonstrate the correctness of the conclusion.

Keywords: Wireless remote control Iterative learning control Channel noise  $l_2$ -norm

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