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信息科学

列车横向半主动悬挂变论域模糊控制

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摘要: 针对复杂的列车横向模型,设计了半主动悬挂变论域模糊控制器。介绍了变论域模糊控制的基本原理,推广了它的收敛条件,并证明其适用于列车横向悬挂系统。给出了17自由度的列车动力学模型,利用Simulink软件建立了列车横向模型。最后,以列车横向速度和加速度作为模糊控制器的输入变量,以阻尼器电流作为模糊控制器的输出变量,设计了潜遗传变论域模糊控制器,并进行了仿真实验。根据实验结果计算了列车横向加速度的最大值、均方根值和功率谱密度最大值,并对变论域模糊控制、普通的模糊控制和被动悬挂进行了对比。仿真结果表明:变论域模糊控制降低了列车横向加速度最大值、均方根值和功率谱密度最大值,控制结果好于普通的模糊控制和被动悬挂。

关键词: 列车 横向半主动悬挂 被动悬挂 变论域模糊控制 加速度均方根值 功率谱密度函数

Variable universe fuzzy control of train lateral semi-active suspension system

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Abstract: A variable universe fuzzy controller was designed for the lateral semi-active suspension system of a train. The convergence condition of variable universe fuzzy was given more widely, which was confirmed to be suitable for the suspension system of train. Then, the lateral model of a 17-DOF vehicle was built by Simulink software based on the theory of dynamics. Finally, a potentially-inherited variable universe fuzzy controller was designed by taking the lateral acceleration and velocity of the suspension as the input variables of controller and the damper current as the output variable of controller. A simulation experiment was carried out at the same time, the max value, root mean square and power spectrum density function's max value of the lateral acceleration were calculated, and the results obtained from the variable universe fuzzy controller, traditional controller and the passive suspension were compared. The simulation results show that those data mentioned above have been decreased, which means that the control results by variable universe fuzzy control are better than those of conventional fuzzy control and passive suspension.

Keywords: train lateral semi-active suspension Passive suspension Variable universe fuzzy control root mean square of acceleration power spectrum density function

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