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Active Vibration Control of Secondary Suspension Based on High-Temperature Superconducting Maglev System

Qingshu LI[1], Zigang DENG[1], Haitao LI[1]

Applied Superconductivity Laboratory, State Key Laboratory of Traction Power, Southwest Jiaotong University, Chengdu 610031, China[1]

High-temperature superconducting (HTS) maglev vehicle system is a kind of self-stable levitation mode which is characteristic of flux pinning of non-ideal type II superconductor, has the outstanding advantages of simple and reliable principle, environmentally friendly and so on. But in HTS maglev vehicle system, the levitation force of the YBCO bulk over a NdFeB guideway is oscillated by the fluctuant external magnetic field, which is easily transmitted to the car body to affect the running comfort. This paper starts with the active vibration absorber of the secondary suspension system of HTS maglev, the electromagnetic linear actuator was applied based on active vibration control. The magnetic force of the electromagnetic linear actuator was controlled to increase the damping of suspension system thus improve the comfort of the maglev system. The experimental platform of active vibration absorber is built, which is composed of four electromagnetic linear actuators and a suspension frame, the electromagnetic linear actuators are placed in four corners of the frame above the four HTS maglev dewars respectively. The magnitude of the electromagnetic force is controlled through AC current to counteract the vibration from the track, the mathematical model of absorber system was built, digital PID control was used to the design of the controller to realize the control of the magnetic force. Then, the designed active vibration absorber of the secondary suspension system was validated under different speed levitation height and field cooling height (FCH). The result of the experiment indicates that the electromagnetic linear actuator will reduce the vibration of magnetic levitation vehicle caused by the fluctuant external magnetic field efficiently. With this method, it can greatly improve the stability of the system and help us to achieve more comfortable.

Keywords: high-temperature superconducting maglev, active vibration control, electromagnetic linear actuator, Simulink simulation