

Study on the Inhibition Effect of Rail Dampers on Rail Wave Abrasion

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Abstract : To prevent the occurrence of rail corrugation and mitigate the influence of existing corrugation, this paper first conducts actual measurements of rail corrugation before and after the installation of the frequency-modulated rail dampers, determines the characteristic frequencies of corrugation and makes comparisons of the time-domain and frequency-domain of the vertical and lateral vibration accelerations of the rails. It indicates that the rail dampers significantly reduce the rail vibration acceleration levels at the characteristic frequencies, and the vibrations are significantly reduced after the installation of the dampers. Additionally, a simulation study is carried out on the wheel-rail system with and without the frequency-modulated rail dampers. The theory that resonance of the wheel-rail system leads to corrugation shows that rail vibration is inseparably associated with the generation of corrugation, and the potential causes of corrugation in each frequency band are explored through the natural frequencies of the system. Finally, the rail vibration attenuation rate index is calculated, describing the absorption effect of the frequency-modulated rail dampers on rail vibration. It indicates that the dampers absorb part of the lateral vibration energy of the rails and have the effect of altering the rail vibration characteristics in the frequency domain. It is considered that they have a positive influence on the suppression of rail corrugation.

Keywords : rail corrugation, frequency-modulated rail damper, finite element analysis, wheel-rail system resonance, rail vibration attenuation rate

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