8th World Conference on Structural Control and Monitoring (8WCSCM)
Orlando, FL, USA 5-8 June 2022

Model Development Of A New Rail Particle Damper And Parameter Optimization Using Fem-Dem Coupling Approach

Chih-Shiuan LIN, Seyed Masoud SAJJADI ALEHASHEM, Yu-Ling WANG, Yi-Qing NI

The impact between the wheel and rail forms intense excitation and causes vibration of the wheel and track, associated with rolling noise. This paper studies the optimal design parameters of a new rail particle damper (RPD). An energy dissipation approach is adopted using the FEM-DEM coupling method. A FEM-DEM model is developed to investigate RPD's performance in controlling rail vibration. Furthermore, a numerical model of a single-bay rail system was developed in which the rail fastening system was simulated with a generalized Maxwell model to reproduce frequency-dependent characteristics of the viscoelastic rail pad. The simulation results were verified through impact hammer experiments of a single-bay rail system. The influence of RPD's parameters such as particle size, cavity size, and damper filling ratio on the vibration reduction performance of the RPD was investigated numerically. The numerical analysis demonstrates that the proposed FEM-DEM coupling model precisely estimates the optimal RPD's design parameters. Finally, the results of this research can provide guidelines for the optimal design of particle dampers in railways.