Bifurcation analysis and hunting behavior of high-speed railway vehicle in a curve

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Abstract
A vehicle body, two bogie frames and two wheelsets for each bogie frame, are used to describe the railway vehicle model. The system dynamic is modeled by using a 38-DOF system including the longitudinal, lateral, vertical, roll, pitch and yaw displacements. A heuristic nonlinear creep model and an elastic rail model are used to simulate the wheel-rail contact. Stable movement and the corresponding limit cycle motion are investigated. In order to study stability, bifurcation analyses are performed. The effects of the longitudinal displacement and the nonlinear elastic rail model on the lateral stability are investigated. Also, whenever possible, in order to demonstrate the accuracy of results, it compared to the available other author's results. It is revealed that the longitudinal displacement does not affect on the lateral stability. In addition, the critical hunting speed and hunting frequency evaluated via the linear elastic rail is higher than that derived using a nonlinear model.

Keyword: railway vehicle dynamics, heuristic nonlinear creep model, critical hunting speed, numerical simulation, bifurcation analysis