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Modelling of Innovative Yaw Dampers for Railway Vehicles

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Nowadays, the tendency to increase the competitiveness of railway vehicles by raising their commercial speed is widely diffused around the world. Such enhanced velocity levels must be reached without decreasing the standard safety levels.

Considering the straight track condition, yaw dampers are the most influencing secondary suspension components of the railway vehicle able to increase the stability during high-speed operations [1], [2]. The dampers contribute reduces the risk of hunting instability and, therefore, it increases the vehicle critical speed. The typical passive yaw dampers are designed to achieve this goal, but, unfortunately, they worsen the curving performances [3]. Indeed, the forces provided by the standard passive devices increase the bogies steering resistance during the negotiation of sharp curves, especially along curve entries and exits, with a consequent increase of the wheel-rail contact forces.

For this reasons, damper manufacturers are studying innovative solutions to modify the internal characteristics of the dampers according to the vehicle working conditions. The goal is to obtain devices able to combine the vehicle stability during the high-speed running and the curving performances in sharp curve negotiation.

In this context, the present work aims at developing a numerical model of the new yaw dampers, validated with experimental results collected on a specific test bench. Then, the numerical evaluation of the vehicle performances with the innovative yaw dampers is carried out by a co-simulation routine: a multibody vehicle model of a real test case, implemented in the Simpack® software, is run together with a Simulink® model of the yaw damper. The performances are analysed taking inspiration from the EN 14363 standard in terms of both high-speed running stability and low speed curve negotiation.

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