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Coupled CFD and MBD methods for dynamic performance analysis of a high-speed train passing through windbreak corridors with various forms

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ABSTRACT

The construction of windbreak facilities is an effective measure to enhance the safety of train operations in the wind zone. The non-constant aerodynamic characteristics of a 350 km/h high-speed train passing through various forms of windbreak corridors in a 30 m/s wind zone are simulated. Dynamic response of the high-speed train is obtained using a joint CFD (Computational Fluid Mechanics) and MBD (Muti-Body Dynamics) offline time-domain simulation method. The calculation method has been verified by experiments. Studies have shown that the smaller the opening, the more stable the airflow, and the better the peak damping effect and fluctuation effect are, with the no windbreak corridor (Case 1) as a control group. The 1/3-opening windbreak corridor (Case 3) effectively mitigates the sudden change of aerodynamic loads at the wind zone transition of the 2/3-opening windbreak corridor (Case 2), and the main fluctuation area of Case 3 is the wind section. Dynamics studies have shown that the 2/3-opening windbreak corridor has insufficient lateral aerodynamic performance. The 1/3-opening windbreak corridor and the fully enclosed corridor (Case 4) effectively ensures travel safety. The results of the study can provide a reference for the design of windbreak corridors and guide the safe operation of trains in windy areas.

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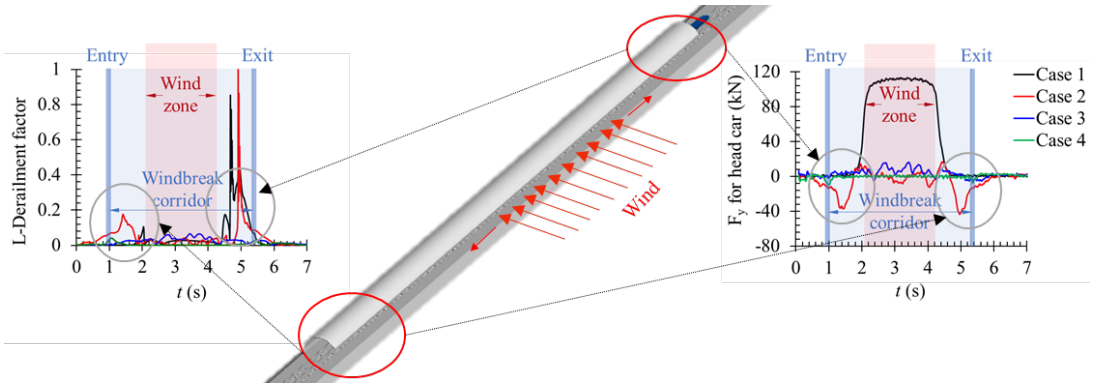

REFERENCES

Chen, Zhengwei, et al. "Comparative analysis of the effect of different nose lengths on train aerodynamic performance under crosswind." Journal of Fluids and Structures 78 (2018): 69-85.

Liu, Dongrun, et al. "Effect of wind speed variation on the dynamics of a high-speed train." Vehicle System Dynamics 57.2 (2019): 247-268.