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Aerodynamic threat of severe wind condition to the running safety of maglev train

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ABSTRACT

Maglev trains represent a highly promising solution for medium to long-distance ground transportation. In recent years, extreme weather events have become more frequent, particularly in coastal areas, where severe wind conditions, such as tornadoes, pose significant threats to the operational safety of maglev trains. This paper employs a transient simulation method based on URANS to numerically predict the aerodynamic characteristics of maglev trains operating in adverse wind conditions. The study considers variations in surface pressure distribution and aerodynamic loads as the train travels at various speeds and different lateral center distances through tornado wind fields of varying intensities. The results reveal that as the train approaches the center of the wind field along the longitudinal direction, the nearby pressure distribution exhibits a transition from symmetrical to asymmetrical patterns, and the opposite trend is observed as the train departs. The aerodynamic load coefficients of the lead car display a double-peak trend, with the peak value of the trailing peak being more significant than that of the leading peak.

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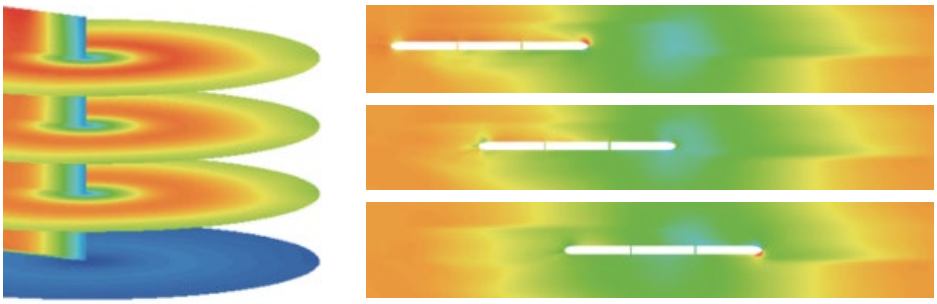

Fig. 1 Tangential velocity distribution of wind field, and pressure distribution around the train at different times.