

## Application of air-blowing in mitigating the risk of train overturning

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### ABSTRACT

In the face of the speed-up demand of high-speed trains, their safety risks in crosswind environments are further increased. Whereas the traditional passive drag reduction either achieves limited overturning moment reduction or requires an increase in other metrics at the cost, this study proposes an active flow control method, specifically referring to the application of blowing on the leeward side of a high-speed train to mitigate the overturning moment suffered by the train. Different blowing positions and speeds were considered. The results show that the best mitigation effect is achieved when the head, center and tail cars are simultaneously blown; moreover, when blowing at 0.3 times the combined speed, the overturning moments of the three cars are reduced by 7.71%, 7.25% and 25.46%, respectively. Finally, an evaluation of the mitigation efficiency is demonstrated, discussing the trade-off between rolling moment reduction by wind blowing and energy utilization. The study proposes to improve train sidewind stability and safety based on active control to increase the threshold of safe train operation.

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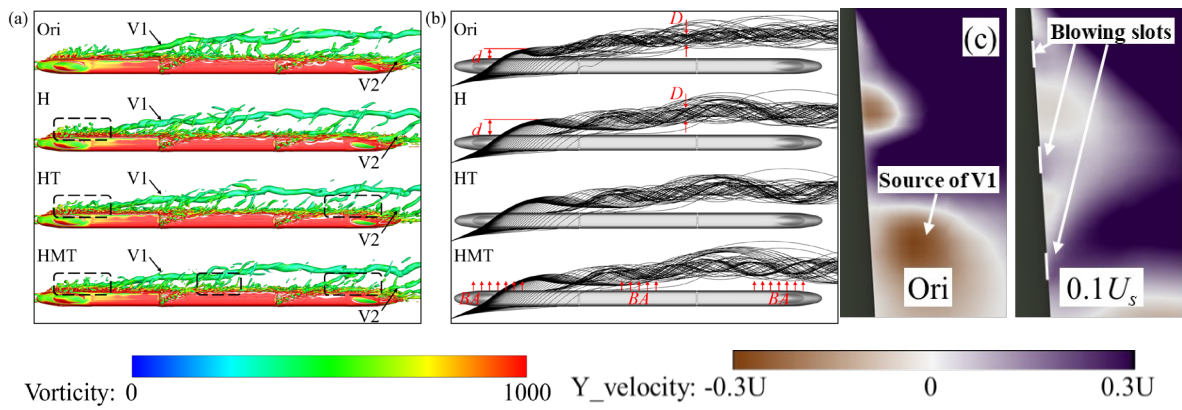


Fig. 1 Flow pattern around the train applying various air-blowing strategies.