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Numerical study on the flow field characteristics of the new high-speed maglev train in open air

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Key words: Maglev train; High-speed; IDDES; Aerodynamic load; Vortex; Time-averaged slipstream

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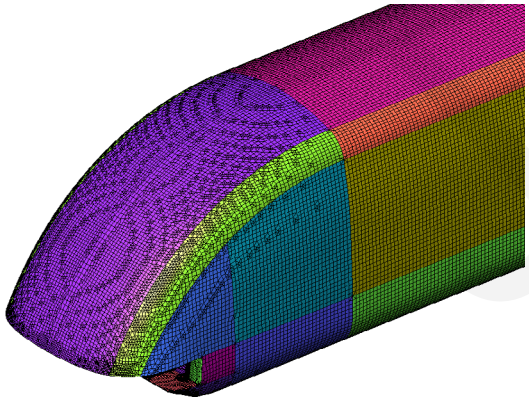
Pursue higher maglev train speed



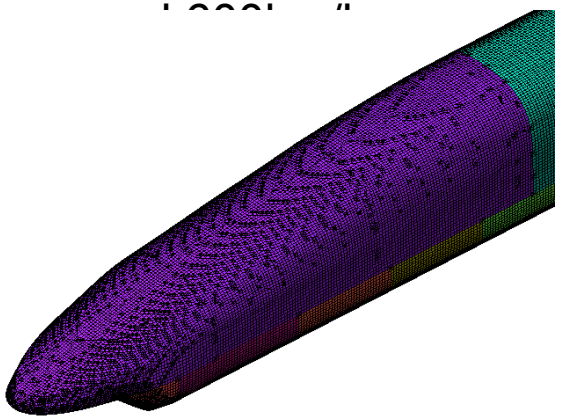


Aerodynamic optimization

Shanghai maglev train
Maximum running speed:430km/h

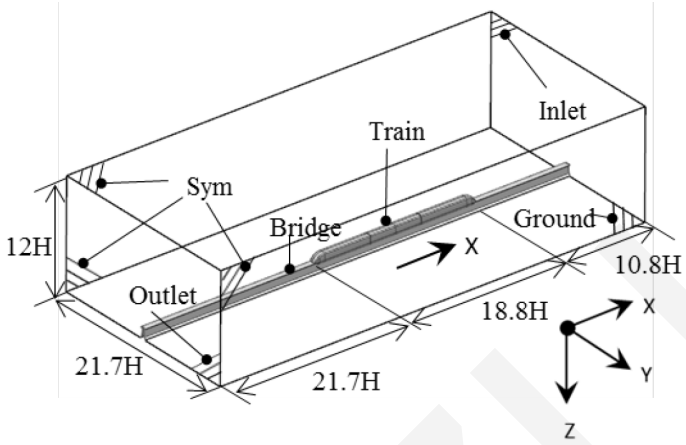


Future maglev train
Maximum running

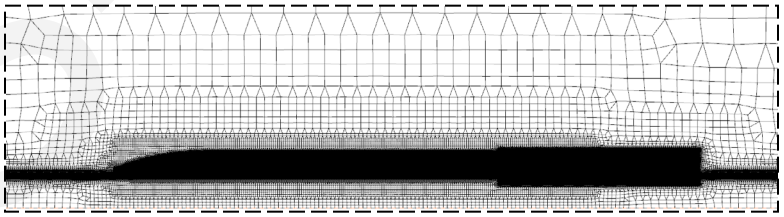


CFD procedures

Domain → Mesh → Solver



(a) Domain

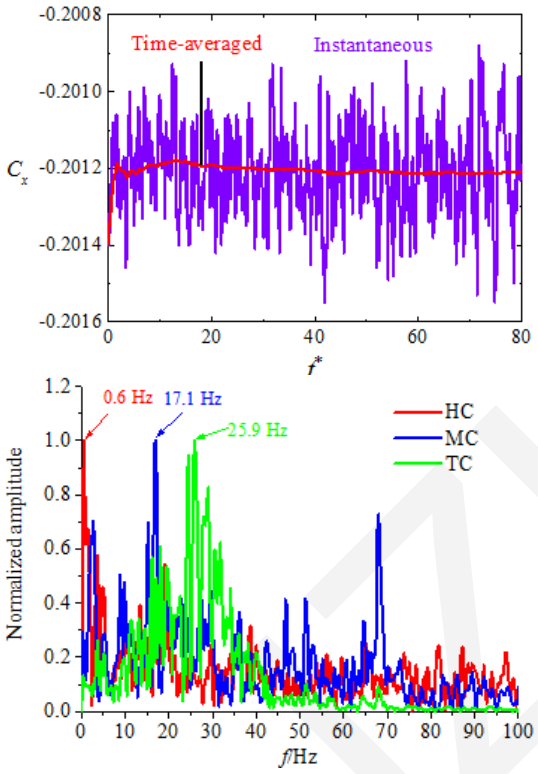


(b) Mesh

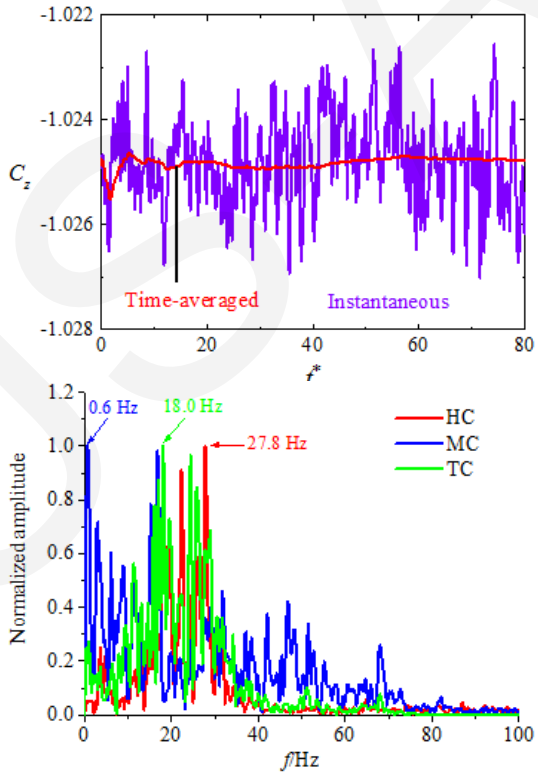
Solver	Density-based
Flux-difference splitting method	Roe
Spatial discretization scheme	Second order upwind
Time-stepping method	Implicit pseudo-time marching
Turbulence modelling	IDDES

Simulation results

Aerodynamic loads



(a) Drag coefficient

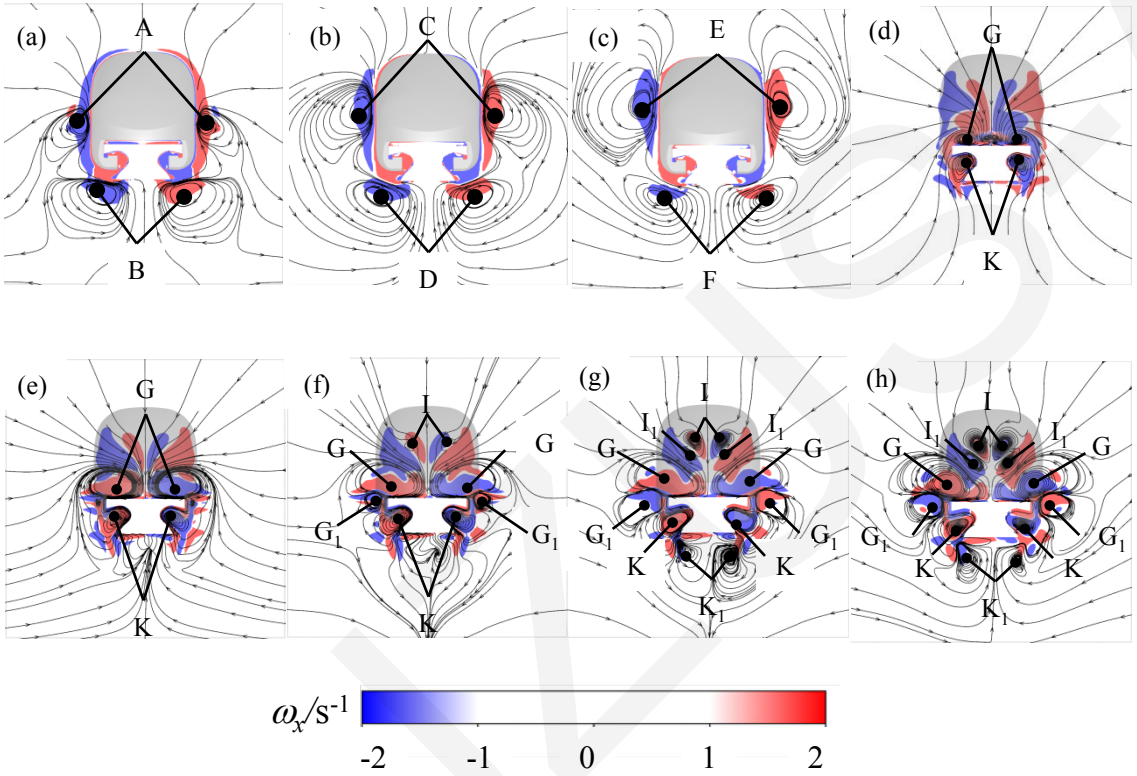


(b) Lift coefficient

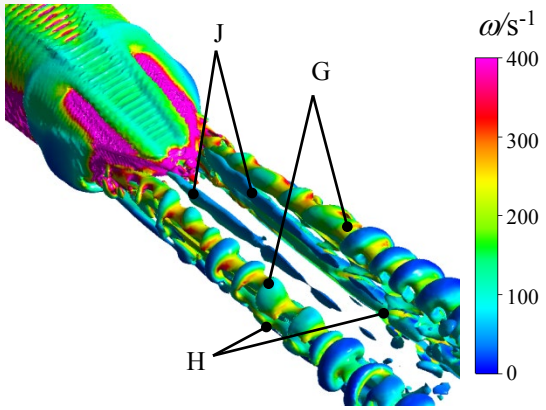
Time-domain and frequency-domain characteristics of loads

Simulation results

Wake vortex



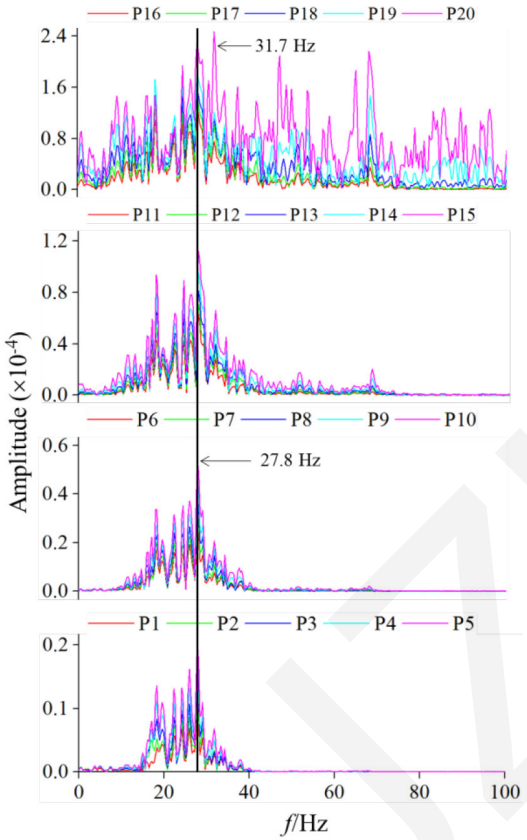
Wake vortex shape at different cross sections



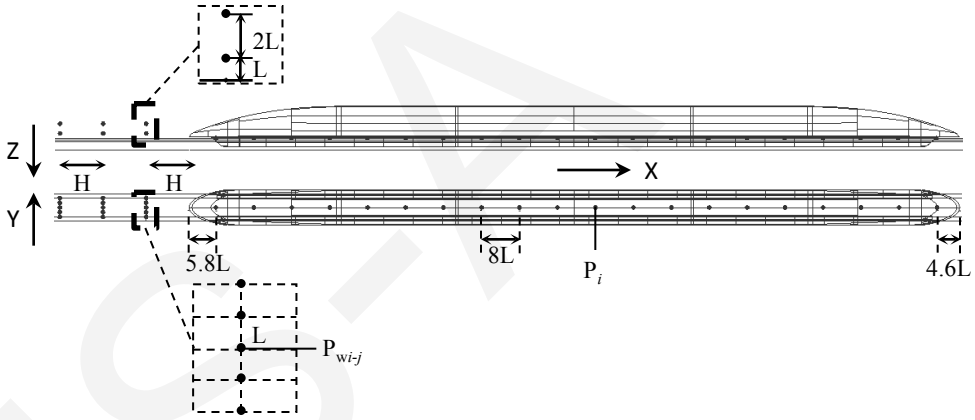
Vortex cores in wake

Simulation results

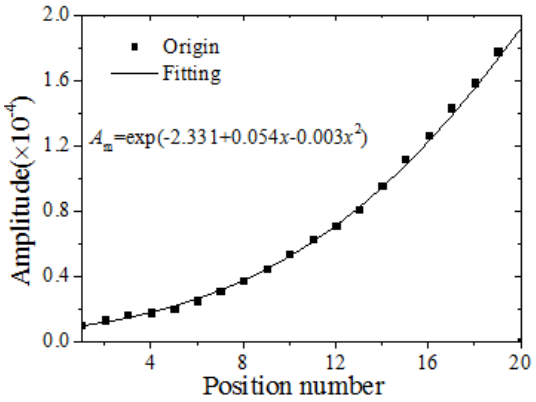
Gap vortex



Variation of pressure coefficient amplitude to frequency for different monitoring positions in the gap



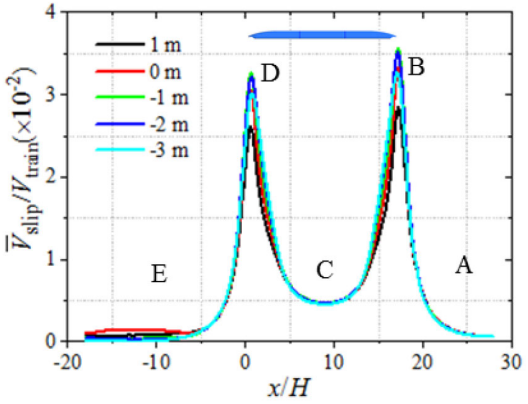
Monitoring point position



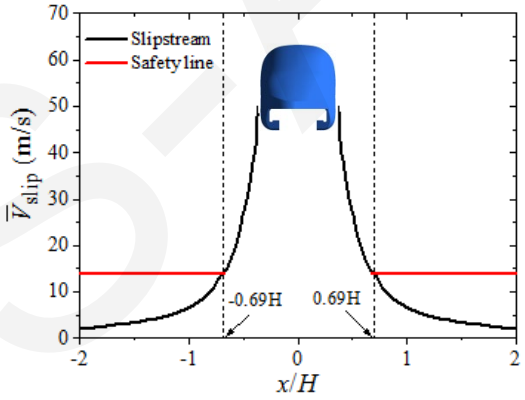
Change of the pressure coefficient amplitude with the monitoring point position

Simulation results

Slipstream



Typical time-averaged slipstream



Safety domain

JZUSA

Conclusions

- The new maglev has some good aerodynamic load performance

- Many high intensity vortices are distributed in the narrow space between skirt plates or train floor and track

- The large vortex shedding from the wall surface may break an obvious rule of wall boundary layer development in that its thickness gradually increases in the streamwise direction.

- The time-averaged slipstream development of the maglev train can be mainly divided into five typical processes.

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