Investigation on the Unsteady Aerodynamics of High Speed Train Ballast Flight

UNIVERSITY OF Southampton

Engineering Doctorate (EngD)

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HS2 Ltd.

Objective:

The project's aim is to utilise Computational Fluid Dynamics (CFD) tools such as AnSys, Star CCM+ and OpenFoam to tackle unsteady flow phenomena related to High Speed Trains (HST), especially the vortical flow between train carriage and track, to achieve better understanding of the physics behind ballast flight. Work presented in this paper concentrates on flow over a model for HST nose and leading bogie area to grasp the theory and application and extend it towards more complex geometries.

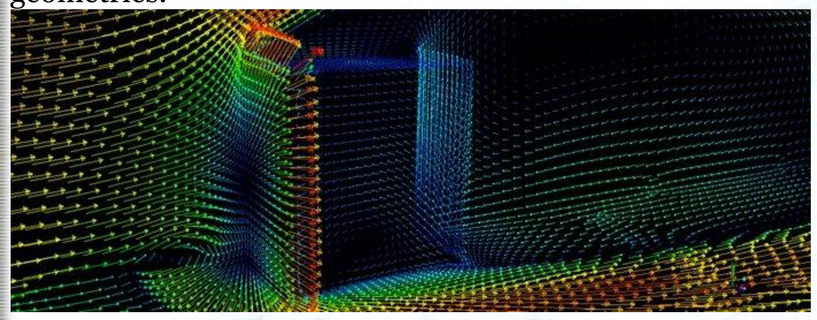

***Figure 1**: Velocity profile of the cube undergoing free stream flow.*

The project will investigate the unsteady flow for different types of tracks to highlight the influence of track layout on ballast projection, and will model the train carriage for different train operating conditions. Outcomes from the project will help to understand the phenomenon of ballast projection and to improve HST design.

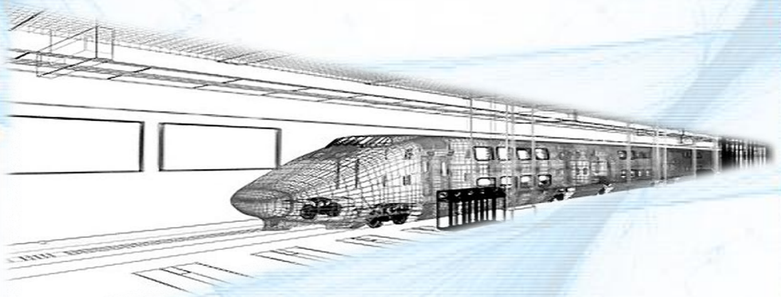

***Figure 2**: Wireframe geometric model of a high speed train.*

Further validations would be required after simulation by performing wind tunnel experiments using a scaled model to clarify its consistency.

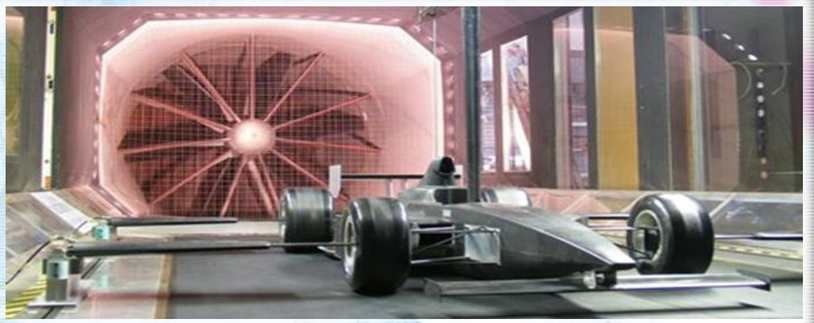

***Figure 3**: R J Mitchell Wind Tunnel Facility at Southampton University.*

Topic Areas:

- Computational Fluid Dynamics.
- Turbulent Flow Modelling.
- Finite Elements.
- Particle Physics.
- Wind Engineering.
- Applied Aerospace.
- Dynamics and Vibration Analysis.
- Ballast Flight.
- Impact Analysis.

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