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Reducing the Drag and Damage of a High-Speed Train by Analyzing and Optimizing its Boundary Layer Separation and Roll-up into Wake Vortices CHUNG-HSIANG JIANG, PHILIP MARCUS, UC Berkeley — We present numerical calculations of the boundary layers and shed wake vortices behind several aerodynamic bodies and generic models of high-speed trains. Our calculations illustrate new visual diagnostics that we developed that clearly show where the separation of a boundary layer occurs and where, how, and with what angles (with respect to the stream-wise direction) the wake vortices form. The calculations also illustrate novel 3D morphing and mesh "pushing and pulling" techniques that allow us to change the shapes of aerodynamic bodies and models in a controlled and automated manner without spurious features appearing. Using these tools we have examined the patterns of the shed vortices behind generic bodies and trains and correlated them with the changes in the drag as well as with the effects of the shed vortices on the environment. In particular, we have applied these techniques to the end car of a next-generation, high-speed train in order to minimize the drag and to minimize the adverse effects of the shed vortices on the track ballast.

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