

Multi-objective optimization design method of the high-speed train head

高速列车车头的多目标优化设计方法

Cite this as: Meng-ge Yu, Ji-ye Zhang, Wei-hua Zhang, 2013. Multi-objective optimization design method of the high-speed train head. *Journal of Zhejiang University-SCIENCE A (Applied Physics & Engineering)*, 14(9):631-641. [doi:10.1631/jzus.A1300109]

The main goal of this paper

The multi-objective optimization design method of the high-speed train head is proposed to reduce the aerodynamic drag and to improve the operational safety.

Main aspects involved in the multi-objective optimization

Establishment of 3D parametric model, the aerodynamic mesh generation and aerodynamic computation, the vehicle system dynamics, and the multi-objective optimization algorithm(NSGA-II).

Multi-objective optimization design procedure

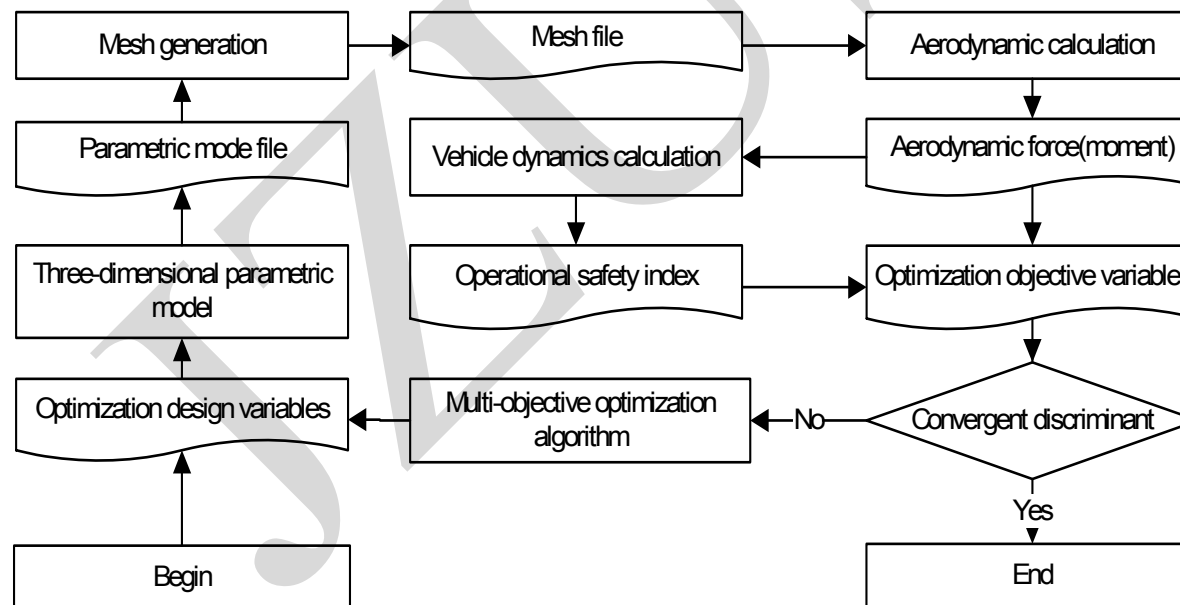


Fig. 1 Overall design flow for optimization

Computational model and results

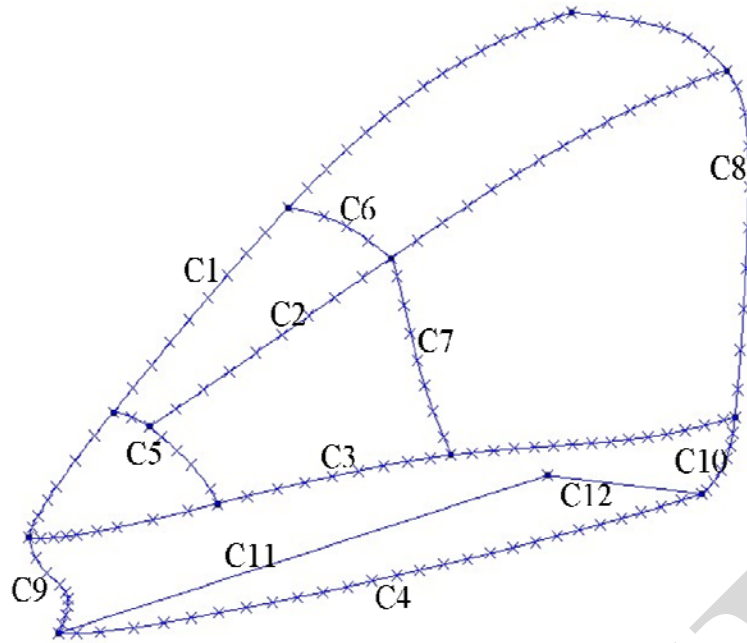


Fig. 2 Left half model of the train head

5 optimization variables: dz_1 , dy_3 , dy_4 , dy_7 and n_{scale} , corresponding to the C1, C3, C4, C7, and the nose height, respectively.

2 optimization objectives: the aerodynamic drag and the load reduction factor.

Pareto-optimal front

After optimization, the aerodynamic drag is reduced by up to 4.15% and the load reduction factor is reduced by up to 1.72%.

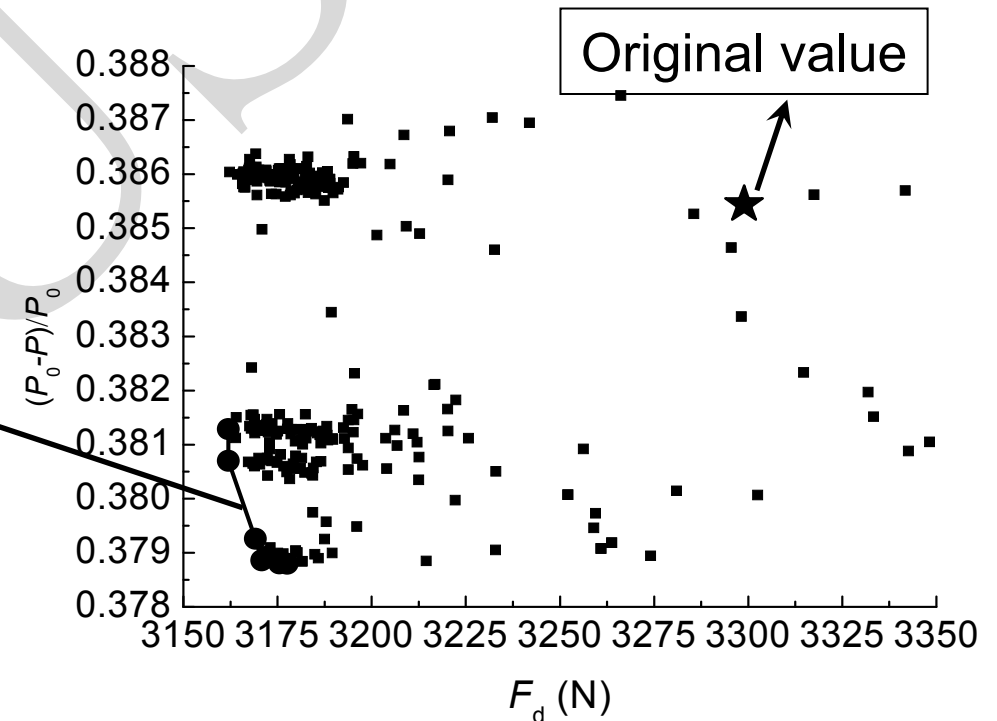


Fig 10 Pareto-optimal front of the head shape optimization