Train Nose Optimization Based on Linear Acoustic Theory for Reducing Micro-pressure Waves

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Shapes of train noses have been optimized for reducing the peak value of a micro-pressure wave radiating from tunnel portals of high-speed railways. In this study, the shapes of multistep noses were optimized using three transfer functions based on the linear acoustic theory (W_T), experimental results (W_E), and their average (W_M). Model experiments were undertaken to measure values of the maximum pressure gradients of compression waves generated by each train nose entering a tunnel for an offset running. For optimized train noses based on W_T or W_E, the values of the maximum pressure gradient were not sufficiently reduced, and the pressure gradient waveforms were not trapezoidal shapes. Although optimized noses based on W_M well reduced the maximum pressure gradients, the values of the maximum pressure gradient were larger than those for optimized noses based on the computational fluid dynamics.