

Development and Application of a Numerical Simulation for a Large-Scale Low-Noise Wind Tunnel

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This study presents a numerical wind tunnel that replicates the airflow environment of the Maibara Large-Scale Low-Noise Wind Tunnel at the Railway Technical Research Institute. The tool integrates detailed geometric modeling using a 3D laser scanner with high-fidelity flow simulations performed on the RTRI's computational platform. Validation against physical wind tunnel tests demonstrated a strong consistency in airflow characteristics. By reducing the number of required test conditions and measurement points, this numerical tool enhances the efficiency and accuracy of wind tunnel testing. When used alongside conventional experiments, it accelerates research workflows and provides a complementary means for investigating aerodynamic issues.