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Aeroacoustics wind noise optimization for vehicle's side mirror base

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Abstract: Extreme effect of noise pollution includes deafness and mental breakdown and in main cities automobiles are a main source of noise. The literature concentrates on the side mirror part and lacks analysis on mirror base (arm) that connects the mirror part to the vehicle's body. This work focuses on lowering noise emission from vehicles by optimizing the orientation of the mirror base. In this manuscript, the connection between the mirror and its base is set as a vertical rotational axis, and multiple angles are examined to determine the optimal angle for the mirror base ranging from 0 to 90°. The Scale Adaptive Simulation (SAS) model is utilized for the simulation combined with Ffowcs-Williams and Hawkings as the acoustics model. The simulation is conducted using ANSYS Computational Fluid Dynamics to analyse the real case. The results show that, the optimal orientation of the mirror's base is 85° relative to the horizontal axis, as it yields minor acoustic noise and relatively the best aerodynamic force performance. The difference in changing the mirror base orientation results up to 32 dB difference in sound pressure level.