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A Computational Analysis of Flow and Acoustics around a Car Wing Mirror

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Abstract : The automotive industry is continually aiming to develop the aerodynamics of car body design. This may be for a variety of beneficial reasons such as to increase speed or fuel efficiency by reducing drag. However recently there has been a greater amount of focus on wind noise produced while driving. Designers in this industry seek a combination of both simplicity of approach and overall effectiveness. This combined with the growing availability of commercial CFD (Computational Fluid Dynamics) packages is likely to lead to an increase in the use of RANS (Reynolds Averaged Navier-Stokes) based CFD methods. This is due to these methods often being simpler than other CFD methods, having a lower demand on time and computing power. In this investigation the effectiveness of turbulent flow and acoustic noise prediction using RANS based methods has been assessed for different wing mirror geometries. Three different RANS based models were used, standard k-ε, realizable k-ε and k-ω SST. The merits and limitations of these methods are then discussed, by comparing with both experimental and numerical results found in literature. In general, flow prediction is fairly comparable to more complex LES (Large Eddy Simulation) based methods; in particular for the k-ω SST model. However acoustic noise prediction still leaves opportunities for more improvement using RANS based methods.

Keywords : acoustics, aerodynamics, RANS models, turbulent flow
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