World Academy of Science, Engineering and Technology
International Journal of Aerospace and Mechanical Engineering
Vol:12, No:06, 2018

Aerodynamic Design Optimization of High-Speed Hatchback Cars for Lucrative Commercial Applications

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Abstract : The choice of high-speed, low budget hatchback car with diversified options is increasing for meeting the new generation buyers trend. This paper is aimed to augment the current speed of the hatchback cars through the aerodynamic drag reduction technique. The inverted airfoils are facilitated at the bottom of the car for generating the downward force for negating the lift while increasing the current speed range for achieving a better road performance. The numerical simulations have been carried out using a 2D steady pressure-based   k-ε realizable model with enhanced wall treatment. In our numerical studies, Reynolds-averaged Navier-Stokes model and its code of solution are used. The code is calibrated and validated using the exact solution of the 2D boundary layer displacement thickness at the Sanal flow choking condition for adiabatic flows. We observed through the parametric analytical studies that the inverted airfoil integrated with the bottom surface at various predesigned locations of Hatchback cars can improve its overall aerodynamic efficiency through drag reduction, which obviously decreases the fuel consumption significantly and ensure an optimum road performance lucratively with maximum permissible speed within the framework of the manufactures constraints.

Keywords : aerodynamics of commercial cars, downward force, hatchback car, inverted airfoil
Conference Title : ICAMAME 2018 : International Conference on Aerospace, Mechanical, Automotive and Materials Engineering
Conference Location : Paris, France
Conference Dates : June 25-26, 2018