

Simulation Study on Vehicle Drag Reduction by Surface Dimples

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Abstract : Automotive designers have been trying to use dimples to reduce drag in vehicles. In this work, a car model has been applied with dimple surface with a parameter called dimple ratio DR, the ratio between the depths of the half dimple over the print diameter of the dimple, has been introduced and numerically simulated via k- ϵ turbulence model to study the aerodynamics performance with the increasing depth of the dimples. The Ahmed body car model with 25 degree slant angle is simulated with the DR of 0.05, 0.2, 0.3, 0.4 and 0.5 at Reynolds number of 176387 based on the frontal area of the car model. The geometry of dimple changes the kinematics and dynamics of flow. Complex interaction between the turbulent fluctuating flow and the mean flow escalates the turbulence quantities. The maximum level of turbulent kinetic energy occurs at DR = 0.4. It can be concluded that the dimples have generated extra turbulence energy at the surface and as a result, the application of dimples manages to reduce the drag coefficient of the car model compared to the model with smooth surface.

Keywords : aerodynamics, boundary layer, dimple, drag, kinetic energy, turbulence

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