

Numerical analysis of air-flow and temperature field in a passenger car compartment

Abstract :

This paper presents a numerical study on the temperature field inside a passenger's compartment of a Proton Wira saloon car using computational fluid dynamics (CFD) method. The main goal is to investigate the effects of different glazing types applied onto the front and rear windscreens of the car on the distribution of air-temperature inside the passenger compartment in the steady-state conditions. The air-flow condition in the passenger's compartment is also investigated. Fluent CFD software was used to develop a three-dimensional symmetrical model of the passenger's compartment. Simplified representations of the driver and one rear passenger were incorporated into the CFD model of the passenger's compartment. Two types of glazing were considered namely clear insulated laminated tint (CIL) with a shading coefficient of 0.78 and green insulated laminate tint (GIL) with a shading coefficient of 0.5. Results of the CFD analysis were compared with those obtained when the windscreens are made up of clear glass having a shading coefficient of 0.86. Results of the CFD analysis show that for a given glazing material, the temperature of the air around the driver is slightly lower than the air around the rear passenger. Also, the use of GIL glazing material on both the front and rear windscreens significantly reduces the air temperature inside the passenger's compartment of the car. This contributes to a better thermal comfort condition to the occupants. Swirling air flow condition occurs in the passenger compartment. The air-flow intensity and velocity are higher along the side wall of the passenger's compartment compared to that along the middle section of the compartment. It was also found that the use of glazing materials on both the front and rear windscreen has no significant effects on the air-flow condition inside the passenger's compartment of the car.