105_Experimental and Numerical Analysis of Vehicle Grille Nozzle Air Flow for Engine Bay Cooling

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Experimental and Numerical Analysis of Vehicle Grille Nozzle Air Flow for Engine Bay Cooling

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Abstract. New technologies are emerging in order to improve engine power with efficient methods of heat rejection through radiator. The vehicle under-hood temperature is a major concerned of engine performance. The vehicle grills commercially available are aesthetically designed. However, grille opening shape and air mass flow rate are important in engine cooling of the vehicle. In this paper, an attempt has been made to reduce the temperature of engine bay using newly designed vehicle front grille. The vehicle grill is designed and developed with a convergent nozzle shape such that larger cross section acts as inlet of air and smaller one would be exit towards the engine bay. This causes the pressure difference with rise in velocity, causing the efficient circulation of air in the engine bay with substantial decrease in temperature. Further, the air striking the radiator and entering the engine bay leads to a considerable increase in performance and efficiency of the engine. The numerical and experimental performance of various cross section nozzles both individual and as entire grill were performed and analyzed to predict front end airflow pattern. The nozzle with rectangular inlet and elliptical outlet reported to be the most optimum design attaining the maximum temperature drop.

Keywords: Engine bay cooling, vehicle grill, convergent nozzle.

1 Introduction

In automotive vehicle, the internal combustion engine cooling is important to extract the waste heat from the engine bay. Cooling is needed because hood under high temperatures tend to damage engine components. Cooling becomes most important when the climate becomes very hot especially in the Indian subcontinent region. Therefore, engine cooling system is employed to remove heat quickly and to keep temperatures low so the engine can survive at elevated temperature. The conventional grille available in today's vehicles is aesthetically designed without much engineering constraint. As a large portion of air coming in contact with vehicle enters the engine bay through grille. This air entered inside engine bay improve the heat carrying capacity of radiator as well as keeps engine cool with natural draught. Many researchers were worked in this area of engine bay cooling in which Kim et al. stress upon key design geometric parameters like vertical height, horizontal width, size, linear deformation, position, blockage, aerodynamic drag and grille inlet flow rate for cooling performance of the car [1]. Kim et al expressed about front-end airflow pattern for engine cooling [2]. D,Hondt performed study on flow around engine compartment and commented about lower aerodynamic drag to decrease CO_2 and greenhouse gas emissions. Author corelates the aerodynamic drag with the cooling air flow and suggested method of reducing cooling drag and increasing air flow rate [3]. Importance of internal airflow to improve engine cooling

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CERTIFICATE OF PARTICIPATION

This Certificate is presented to

Vinay Dahyabhai Patel

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