Influence of Ground Effect on Vehicle Cooling-Air-Flow Distribution

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ABSTRACT

The vehicle produces the heat dissipation problems in the driving. In the analysis of thermal management of the engine and cooling system, enough cooling-air-flow of radiator in the front of underhood will directly keep performance in efficiency of engine effectively. Therefore, in the cooling system analysis of underhood, mass airflow rate through radiator is a key parameter for the cooling system efficiency. It directly influences on the economy of the fuel. This research adopts computation fluid dynamics (CFD) as the method. It will show the effect of the parameters of ground clearance moving wall and rotating wheels. This study will discuss how these elements influence the cooling flow distribution on the vehicle. This research will examine how the ground effect parameter influences the mass airflow rate through radiator of underhood, inlet and outlet flow distribution under the driving state in the idle speed at 50km/hr, 110km/hr, and 180km/hr. The result indicates that ground clearance is the main influence of the mass airflow rate through radiator of underhood. In idle speed, the error of mass airflow rate through radiator between maximum ground clearance and minimum ground clearance is 8%, and the error of the two cases reaches 15% when the travel speed is raised to 180km/hr. After analyzing the parameters of the moving ground and rotating wheels in different ground clearance, the numerical analysis the mass airflow rate through radiator does not have great influences. Thus, the degree of influence can be neglected. Applying the influences of the parameter of vehicle scale model and ground effect, the error of mass airflow rate through radiator between 50km/hr full vehicle model and half vehicle model is about 1% and compared to 180km/hr underhood model, the error between the two is 3%. This results accord with the trend [12] of the flow in references.

Keywords : ground clearance ; ground effect ; cooling -air-flow

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