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## A Numerical Analysis on Air-cooling Performance of Passenger Cars

SAE International

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The influence of environmental changes on underhood and underbody components of a vehicle is an important issue in new vehicle design as increased engine power, cabin comfort demands and package space limitations create an increasingly difficult problem to solve. Sufficient airflow needs to be available for adequate cooling of the underhood components. The amount of air mass flow depends on the underhood geometry details: positioning and size of the grilles, fan operation, and the positioning of the other underhood components. This paper describes a prediction methodology that significantly streamlines the process of passenger car underhood thermal management by utilizing state-of-the-art computer simulation of airflow. The methodology uses a complete 3-D CAD model of all pertinent underhood components of a passenger car with a general purpose Computational Fluid Dynamics (CFD) code to simulate underhood airflow. The heat exchangers condenser and radiator were modeled using a porous media approach by giving the porous coefficient values from the experimentally obtained flow rate versus pressure drop data. The results obtained from the simulation is compared with the experimental values and found that a deviation of about 7.6% in the radiator front average velocity.

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