Improvement on Aerodynamic Characteristics and Drag Reduction for Supermileage Cars with Wide View Field

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ABSTRACT

In order to obtain low drag coefficient, the external shape of supermileage cars used to employ slender, streamlined, and low-height design concepts, resulting in a narrow view field and poor comfort for the driver. In this study, aerodynamic characteristics of three supermileage cars with new design concept for driver ' s wide view field and improved driving comfort is investigated and compared with one with traditional design. New car shapes with shorter axle distance and higher center of gravity are created. Feasibility of the new designs is verified in this work from the aspects of rollover safety, due to the maximum crosswind speed of 40 km/hr, and the drag coefficient at straight driving up to 40 km/hr. The analytical verification is mainly conducted with Ansys Fluent. Part of the CFD results are further confirmed with Flow Vision software. Pressure coefficient distributions, velocity fileds, and drag coefficients are presented. Interesting separation phenomina and vortex structures in the wake are also discussed.

Conclusions drawn from the CFD results are as follows.

1. Comparing to traditional design, it is possible to obtain lower drag coefficient and total drag for a supermileage car with wider view field and taller appearance. Results of this study can provide new concepts that are different from those used in the past for the development of supermileage cars.
2. Rollover safety problem can easily be solved with resonable spacing between two front wheels.
3. Reducing stagnation zone and increasing pressure recovering area are both important in the reduction of the drag coefficient.
4. The body shape near the rear part of a car strongly affects flow separation phenomina, the pressure recover on the rear surfaces, and the vortex structures in the wake.
5. Reduction of the form drag is intemitely related to the decrease of velocity curl in the flow direction and the size of the vortex in the wake.

Keywords: supermileage car, aerodynamic, rollover safety, drag, vortices.

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