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## Study on the effect of window opening on the drag characteristics of a car

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**Abstract:** In this study, the effect of window opening on the drag characteristics of a car is investigated. This additional aerodynamic drag can considerably affect the performance of a car in terms of instability, noise and fuel consumption. Using a 3D car model, the effect of window opening on the drag characteristics was numerically studied using STAR-CCM+ commercial CFD software. It was observed that the aerodynamic drag is highly influenced by the different window openings. For validation, a scaled down car model was tested in the IIUM low speed wind tunnel. The results obtained from both simulation and experimental data showed that the car with all windows open produced higher drag than a car with all windows closed. The experimental data from the wind tunnel test results was found to be in good agreement with the simulation counterpart for the determination of drag coefficient for both window positions.

**Keywords:** aerodynamic drag; computational fluid dynamics; STAR-CCM+; experiment; wind tunnel; modelling; testing.

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**Biographical notes:** Jaffar Syed Mohamed Ali received his MTech and PhD in Aerospace Engineering from Indian Institute Technology Madras in 1993 and 1998, respectively. Currently, he is serving as an Assistant Professor at the Department of Mechanical Engineering, International Islamic University Malaysia. His research interests include aircraft structures, composite structures and computational mechanics.