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## **Documents**

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Experimental and Numerical Investigations of Drag Reduction on a Van Using a Side Flap (2025) Iranian Journal of Science and Technology - Transactions of Mechanical Engineering, 49 (1), pp. 445-461.

DOI: 10.1007/s40997-025-00838-6

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#### Abstract

The present study aims to examine the effect of a side flap on drag reduction and rolling moment stability as a passive flow control mechanism installed on a scaled square back van model, through both experimental and computational methods. The side flap significantly reduces drag, with the greatest decrease occurring when the flap is mounted at a 10° angle. The experimental work was carried out in a wind tunnel under low-speed conditions, with Re = 5.1 × 106, and the aerodynamic force data were obtained through the utilization of a six-component force balance, while the simulation was performed using ANSYS-Fluent on a geometrically similar model at the same Reynolds number. Various flap mounting angles were evaluated to compare results and highlight the influence of the side flap on the wake area. The most advantageous angle was determined to be 10° resulting in up to 7% drag reduction. The optimal mounting angle was selected for the investigation of vehicle stability in crosswind conditions. The presence of the side flap has a notable effect on the drag reduction and stability of the van, resulting in a decrease in drag by about 7% and an improvement in rolling moment by 8% when subjected to a free stream flow yaw angle of 12°. © The Author(s), under exclusive licence to Shiraz University 2025.

#### **Author Keywords**

CFD; Crosswind; Drag reduction; Stability; Van; Wind tunnel testing

#### Funding details

University of International RelationsUIR International Islamic University MalaysiaIIUM

This work is supported by the International University of Rabat (UIR). The authors express their gratitude to the Aerodynamic Laboratory of the International Islamic University of Malaysia (IIUM) for granting them access to the wind tunnel facilities. They also extend their thanks to the LERMA laboratory for providing the in-house computing resources.

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