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BUCKLING AND POSTBUCKLING PERFORMANCE OF COMPOSITE FUSELAGE PANELS WITH CUTOUTS USING CONTINUOUS STREAMLINE FIBRES

AHMAD ALHAJAHMAD[*], CHRISTIAN MITTELSTEDT[†]

[*] TU Darmstadt (Darmstadt University of Technology)
Otto-Berndt-Straße 2, D-64287 Darmstadt, Germany
ahmad.alhajahmad@klub.tu-darmstadt.de, https://www.tu-darmstadt.de

[†] TU Darmstadt (Darmstadt University of Technology)
Otto-Berndt-Straße 2, D-64287 Darmstadt, Germany
christian.mittelstedt@klub.tu-darmstadt.de, https://www.tu-darmstadt.de

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ABSTRACT

In this paper the buckling and postbuckling behaviour of variable-stiffness composite fuselage panels with window openings based on streamline fibres is addressed. Streamlines of a fluid flow around a given body that represents the cutout are adopted to define the fibre trajectories that curve around the cutout in a continuous fashion. Plates and shells with circular and elliptical cutouts subjected to compressive and shear loads are investigated. Various design scenarios using different laminate layups are considered. As a first step, an optimum stacking sequence is obtained for maximum buckling capacity. Then, a postbuckling analysis is performed to evaluate the initial postbuckling stiffness that represents the strength of the laminates beyond buckling. The buckling and postbuckling performance of panels with streamline fibres is compared with that obtained for traditional panels with straight fibres. It is shown that significant improvements in the buckling capacity can be achieved using streamline fibres instead of straight ones. Moreover, laminates with streamline fibres optimized for maximum buckling loads exhibit a higher postbuckling strength than do the laminates with straight fibres.