



Crush energy absorption in ply drop regions

Thesis / Internship

Date:	08/08/2022		
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The use of fiber-reinforced composites in the aerospace, automotive and maritime industries has seen a rapid increase over the past decades thanks to their high specific properties. At the same time, the potential of these materials has not been fully utilized due to the complexity in the analysis and the large design space of non-conventional fibre orientations.

Non-conventional laminates with many ply-drops exhibit competing damage and failure mechanisms. By tailoring these mechanisms, a high amount of energy can be absorbed before complete failure which makes them suitable in structures meant for crash absorption. Currently, crash absorption structures are mostly made of metals. For example, the landing gears of helicopters.

Objective

The objective of this work is to develop guidelines for the design of crush energy absorption in composite laminates with ply-drop rich regions by developing and validating a model for progressive damage and failure mechanisms.

Activities

To reach the objective the following activities are envisioned:

1. Research existing energy absorption models and investigate composite damage mechanisms
2. Develop an FEA model to predict crushing behaviour for a laminate specified in terms of ply drops and fibre orientations
3. Report on the validity, accuracy, and limitations of the created FEA model
4. Develop and validate guidelines for the effect of ply drops on the energy absorption capabilities of a laminate

Deliverables

The following deliverables are envisioned:

1. A model for crushing energy absorption that considers ply-drops and fibre orientations
2. A report on the accuracy of the developed model and validation