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Instability of Unidirectional Fiber Composites in Compression

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Description:

Designing with fiber composites has many good properties. In general, composites are light and stiff and, in most cases, they have a high strength as well. This all sounds very good so why not use them in any structural application? While there are many advantages, there are also many difficulties in knowing how to handle the material response of fiber composites. One of the difficulties is how to handle compression. For example, the compressive strength of an epoxy matrix reinforced by unidirectional carbon fibers in the direction of the loading is often less than 60 per cent of the tensile strength. During the years, different material models have been suggested to account for this compression complexibility.

The aim of this project is to verify one of these simpler smeared out models using the finite element method. The main focus is on kink band formation which is a common failure in fiber composites in compression. By mapping mechanisms of deformation, we can better exploit the good properties of composite materials and thereby produce lighter and stronger structures.

The results of the research can be used in the development of commercial finite element software. In general, it can be applied in all contexts where composite materials are used, e.g. the wind turbine, aerospace and automotive industries, and can contribute to developing the green energy sector.

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