Segmentation of individual fibres in a uni-directional composite from 3D X-ray computed tomography data

Emerson, Monica Jane; Jespersen, Kristine Munk; Dahl, Anders Bjorholm; Conradsen, Knut; Mikkelsen, Lars Pilgaard

Publication date: 2016

Document Version
Publisher's PDF, also known as Version of record

Link back to DTU Orbit

Citation (APA):
Segmentation of individual fibres in a uni-directional composite from 3D X-ray computed tomography data

Emerson M. J., Jespersen K. M., Dahl A. B., Conradsen K., Mikkelsen L. P.
monj@dtu.dk

MOTIVATION

Wind turbine blades are becoming longer to decrease the cost of energy. They need to stand higher stresses.

TASK

We segment individually uni-directional glass and carbon fibres from tomography data to study the fibre orientation and relate it to the compression strength, a key parameter when designing the blade's load carrying parts.

PIPELINE AND CHALLENGES

- Low quality scans to avoid a long acquisition time.
- Composite materials with high fibre volume fraction.
- Large data sets.

SEGMENTATION AND TRACKING

1. Glass Fibre Reinforced Polymer (GFRP)
2. Carbon Fibre Reinforced Polymer (CFRP)

Detected centres in red and reference centres in yellow.

Accuracy** 99.1%
Accuracy** 100%

FIBRE ORIENTATION

1. GFRP
2. CFRP

COMPRESSION STRENGTH

\[ \sigma' = \frac{G}{1 + \frac{\theta}{\gamma}} \]
(Budiansky et al., 1993)

For a more precise estimate...

...add the spatial distribution

Financial support from CINEMA: the allianCe for ImagiNg of Energy MAterials, DSF-grant no. 1305-00032B under The Danish Council for Strategic Research is gratefully acknowledged.