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

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MOTIVATION

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

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%

**Accuracy measured as correctly found centres in a test image, of size half of a slice.

FIBRE ORIENTATION

1. GFRP
2. CFRP

COMPRESSION STRENGTH

\[ \sigma' = \frac{G}{1 + \theta / \gamma} \]

(Budiansky et al., 1993)

For a more precise estimate...

...add the spatial distribution

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Individual fibre segmentation from 3D X-ray computed tomography for characterising the fibre orientation in unidirectional composite materials. Emerson et al., under submission.