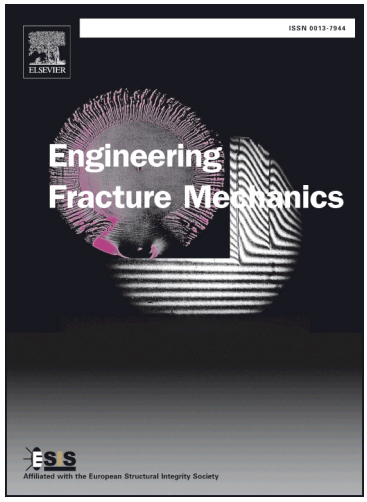

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Effect of fibre volume fraction and fibre direction on crack paths in flax fibre-reinforced composites

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Abstract

Mechanical and fracture mechanical behaviour of composites reinforced with unidirectionally aligned flax fibres is investigated experimentally and numerically. Thereby, the main points are the determination of crack paths in compact tension specimens with three different fibre directions under static as well as fatigue loading and their fatigue crack growth rate curves. Due to the pronounced orthotropic behaviour of those materials the crack path is not only governed by the stress state, but affected by the fibre direction and fibre volume fraction as well. Therefore, the well-known stress intensity factor solutions for the standard specimens are not applicable. Consequently, extensive numerical simulations have been carried out to evaluate the stress intensity factor evolution along the growing crack in order to be able to determine fatigue crack growth rate curves. An approach for calculating stress intensity factors analytically with geometry correction factor functions is conducted exemplified for one fibre direction.

Keywords: Natural fibre-reinforced composites, Orthotropic material behaviour, Crack paths, Fatigue crack growth rate curves, Numerical simulation

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