

Stochastic cracking of brittle matrix composites with heterogeneous reinforcement

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Keywords: *stochastic cracking; multifilament yarn; statistics; composite strength; micromechanics; filament.*

Abstract

A model capable of capturing the effect of irregularly structured reinforcement in a brittle matrix is presented. It introduces a homogenization procedure for the state fields at the microscale in the vicinity of a crack bridge. In combination with a mesoscale model for matrix cracking the homogenized state fields are used for explicit calculation of the strain hardening-response of the composite. The model has been formulated for brittle matrix composites with reinforcement that exhibits random properties, e.g. due to random fiber orientation or because of an irregular penetration profile of the matrix into multifilament yarns. In the present paper we use multifilament yarns applied in textile reinforced concrete (TRC) to demonstrate the capabilities of the model. It is used for parametric studies to detect some qualitative and quantitative dependencies between the micromechanical material parameters and strain-hardening response of the composite.