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SPATIALLY DISTRIBUTED ELASTIC-PERFECTLY PLASTIC MATERIAL BEHAVIOR OF SFRC WITH EXPERIMENTAL VALIDATION

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Due to the finite length of reinforcing elements and the plastic characteristics of the matrix material, short fiber-reinforced composites (SFRC) are characterized by a distinct spatially distributed plastic material behavior at finite deformation. To predict the structural response correctly these properties need to be included in the numerical model procedure.

One technique to incorporate such spatially distributed properties are second-order Gaussian random fields [1]. Their discretization by the Karhunen–Loève expansion is based on the correlation structure of the underlying random variables described by correlation functions, which can be sufficiently determined by numerical simulations [2]. However, important information provided by the correlation length cannot be derived by numerical simulations, because the correlation length is a function of the microstructure size. Therefore, experiments are conducted to obtain the spatial distribution of the material properties for tensile test specimens. In addition, numerical simulations of tensile tests are carried out considering different correlation lengths following [3].

Finally, the correlation length is determined by comparing the experimentally obtained spatial distribution with the results of numerical simulations for different correlation lengths. Since the correlation length has a strong influence on the standard deviation of the distributed parameters, the correlation length for the representation of the material property distribution is given for the case, where the numerically and experimentally obtained values coincide best.

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