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MODELING FATIGUE FAILURE USING A VARIATIONAL MULTISCALE METHOD

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Fatigue failure is modeled using a novel variational multi-scale method (VMM). In this approach cohesive elements are selectively embedded in critical regions and the displacement discontinuities are represented through specially constructed discontinuous shape functions. In the present model, accumulation of damage during cyclic loading is included to model fatigue fracture. The instantaneous cohesive stiffness of a material point during reloading is represented as a nonlinear function of traction and number of loading cycles experienced by the material point since the onset of failure. A linear cohesive model is used during unloading cycle. To incorporate fatigue into this model, two parameters are introduced which are calibrated based on classical log-log Paris failure curve between crack advance per cycle and the range of applied stress intensity factor. Numerical examples that highlight the accuracy of the model with respect to Mode I, Mode II and Mixed mode are presented .

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