A Non-Isothermal Thermodynamically Consistent Phase Field Framework For Structural Damage And Fatigue: Application to Plasticity

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ABSTRACT

We present a general thermodynamically consistent non-isothermal non-local phase field framework for the evolution of damage, fatigue and fracture in plasticity under the hypothesis of small deformation. The damage phase field is considered a continuous dynamical variable whose evolution equation is obtained by the Principle of Virtual Power. The fatigue phase field is a continuous internal variable whose evolution equation is considered as a constitutive relation to be determined in a thermodynamically consistent way. In this work, we propose the use of high order finite elements and a semi-implicit scheme to perform the time integration of the equations, which allows us to decouple the variables and use larger time steps. We compare our results with experimental data for tensile and fatigue tests.

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