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Coupled Ductile-Hydrolytic Damage Model based on Variational Constitutive Updates

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Abstract

This work presents a constitutive model suitable for the description of materials showing elastic-viscoplastic behavior and coupled ductile-hydrolytic damage. Such behavior is frequently observed in bioabsorbable materials that have been increasingly used in the development of medical implants (surgical sutures, screws, plates, anchors, stents, etc). An approach for describing this coupling between mechanical and hydrolytic damage is the core and main contribution of the current proposal. The model is embedded within a variational framework in such a way that the update of internal variables is driven by a minimization principle. A complete description of the model is presented as well as operational details related to an incremental algorithm suitable for finite element calculations. Despite the complexity of the phenomena involved in the formulation, it is shown that the update algorithm follows a simple operational scheme. Several numerical tests were carried out at a material point level, showing the model capability to handle coupling effects of ductile and chemical (hydrolytic) damage. Furthermore,

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