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Multiscale Modeling of Mechanical and Environmental Degradation of Heterogeneous Materials using Fracture-based Interface Elements.

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The mechanical and environmental behavior of heterogeneous materials is essentially determined by their composition and microstructure. In many engineering materials, cracking at the various levels of observation also plays a crucial role, for both mechanical damage and chemical/durability attacks. For the last two decades, the group of Mechanics of Materials at UPC-Barcelona, has been developing a model approach for those materials, based on the use of zero-thickness joint/interface elements. Mechanically speaking, these elements are equipped with fracture-based constitutive laws, while from the viewpoint of diffusion they act as preferential channels for faster transport/diffusion of fluids or chemical substances (linear/quadratic/cubic law), which in turn may accelerate mechanical degradation in the context of coupled analysis. In this paper, the main features of the approach are presented as well as some examples of application to different materials. Advantages and disadvantages are finally discussed as well as on-going developments and perspectives for future research.
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