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# Numerical Homogenization of Nacre

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**Abstract :** Nacre, a biological material that forms the inner-layer of sea shells can achieve high toughness and strength by way of staggered arrangement of strong tablets with soft and weak organic interface. Under applied loads the tablets slide over the adjacent tablets, thus generating inelastic deformation and toughness on macroscopic scale. A two dimensional finite element based homogenization methodology is adopted for obtaining the effective material properties of Nacre using a representative volume element (RVE) at finite deformations. In this work, the material behaviour for tablet and interface are assumed to be Isotropic elastic and Isotropic elastic-perfectly plastic with strain softening respectively. Numerical experiments such as uniaxial tension test along X, Y directions and simple shear test are performed on the RVE with uniform displacement and periodic constraints applied at the RVE boundaries to obtain the anisotropic homogenized response and maximum local stresses within each constituents of Nacre. Homogenized material model is then tested for macroscopic structure under three point bending condition and the results obtained are comparable with the results obtained for detailed microstructure based structure, thus homogenization provides a bridge between macroscopic scale and microscopic scale and homogenized material properties obtained from microstructural (RVE) analysis could be used in large scale structural analysis.

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