

Data Driven, neural network assisted nonlinear computational homogenization

Lecture of

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Meet & Greet 

Multiscale finite elements provide a solution to numerical homogenization for nonlinear problems. The effect of the microstructure or design details of a composite, including a nonlinear behavior, for various loadings is transferred to the homogenized medium through the Representative Volume Element RVE technique. The classical nested approach, the so-called FE², where the upper level homogenized model is linked to a lower level RVE model is very expensive. A data-driven alternative based on interpolation of the constitutive law from a number of calculated examples produced off-line from the RVE and classical or neural network metamodels has been proposed. Furthermore, principles of physics-informed neural network PINN training can be used at both scales. Recent developments in the field and proposals for further research for the incorporation of AI tools within computational mechanics will be discussed.