Isogeometric Multiscale modelling of Kirchhoff-Love shell structures

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ABSTRACT

Isogeometric Analysis (IGA) technology [1], an offspring of the Finite Element Method (FEM), allows for the accurate representation of arbitrarily complex structures. Since efficient three-dimensional parametric design using Computer Aided Design (CAD) functions remains an open issue, a significant part of the research has been focused on developing formulations for surface structures. This work will present a Kirchhoff-Love shell formulation for randomly distributed graphene sheets (GS) within a representative volume element (RVE), that takes into account material heterogeneity in a multiscale analysis context [2]. Specifically, shell structures, consisting of graphene reinforced polymer are under study. The stochastic properties of the graphene inclusions are described in three-dimensional representative volume elements (RVEs) that are assumed to deform in a plane stress state. The evaluation of the final constitutive law at the shell midsurface is performed by integration through thickness. Stochastic properties of the graphene inclusions are taken into account with random RVE geometries generated by utilizing the spectral representation method. Finally, since analysis of graphene inclusions is computationally demanding, a distributed parallel algorithm is developed.

REFERENCES

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