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MULTISCALE MODELLING OF CARBON-NANOTUBE REINFORCED COMPOSITES IN THE FRAMEWORK OF A NESTED SOLUTION SCHEME

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The purpose of this study is the investigation of the effects of material nonlinearity in carbon-nanotube reinforced composites (CNT-RCs) using a first-order multiscale analysis. In particular, a homogenization scheme [1] pertaining to linear and periodic prescribed boundary displacements combined with a nested solution scheme was implemented, in order to illustrate the influence of the interfacial stress transfer mechanism on the micro- and macroscopic behaviour of structures comprised of the aforementioned material. To this end, a Representative Volume Element of a CNT-reinforced composite, allowing slippage between the polymer matrix and the CNT fibers embedded within, was subjected to uniaxial strain tests. The CNTs were approximated using Equivalent Beam Elements (EBEs), in the framework of a modified Molecular Structural Mechanics approach [2]. Moreover, the CNT-polymer interaction was modelled using a non-linear bond-slip mathematical description [3], and different interfacial shear transfer mechanisms were considered. Lastly, a cantilever beam consisting of the aforementioned material, subjected to a scaled vertical load, was analysed using the aforementioned nested solution scheme, and pushover curves of the structure were obtained.

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