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Evaluation of Linearization Procedures Sustaining Nonlinear Homogenisation Theories

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This study aims at defining a methodology and a numerical tool for a systematic evaluation of various existing homogenization methods for nonlinear composites. Since the crucial step of such methods lies in the linearization procedure which leads to the definition of a heterogeneous linear comparison material (LCM), we have chosen a composite with a periodic microstructure. This allows us to derive numerically the exact solution of the nonlinear homogenization problem and to define a periodic LCM, whatever the linearization method, for which the exact solution can also be derived. Attention can then be focussed on the relative relevance of the chosen linearization procedure. The reported results refer to the overall stress-strain response of a two-phase periodic composite under tension with a power-law matrix and aligned identical elastic inclusions. The exact solution is compared to predictions derived from the 'modified secant' formulation and from various versions of the 'affine' procedure.

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