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The Eshelby Problem for Elastic-Viscoplastic Materials

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Micro-macro schemes contain two important steps. First, the localization process consist to solve an Eshelby type problem, that is to link the fields inside an ellipsoidal inclusion to those applied in the surrounding infinite matrix. Secondly, an averaging process is used to derive the macroscopic behavior. For elastic viscoplastic materials, no exact solution exists for the first step. In this work, we adopt a simple but salient interaction law proposed by Molinari (2002). To validate the interaction law, Finite element comparisons are conducted for different inclusion shapes, values of the material parameters. and for incompressible and compressible elasticity. It is observed that the localization step (non-linear Eshelby problem) is well described. Finally, the proposed interaction law is used in association with averaging schemes, to obtain the macroscopic behavior of multiphase elastic-viscoplastic materials.

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