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A simple history-dependent remeshing technique to increase finite element model stability in elastic surface deformations. (English) Zbl 1483.74088

J. Comput. Appl. Math. 405, Article ID 113876, 14 p. (2022).

Summary: In this paper we present and validate a simple adaptive surface remeshing technique to transfer history dependent variables from an old distorting mesh to a new mesh during finite element simulations of elastic surface deformation. This technique allows us to reduce the error arising from excessive mesh distortion whilst preserving information about the initial configuration of the mesh and the history dependent variables. The transfer technique presented here constructs the initial configuration of the new mesh by considering the distortion incurred by the elements of the old mesh and projecting backwards in time. Using this new initial configuration, the stress and strain over the new mesh can be easily calculated. After presenting the necessary steps to reconstruct the initial configuration, we show that this relatively simple transfer technique adds stability to finite element simulations and reduces the spatial error and the strain error across the domain. The novel transfer technique presented in this paper is easy to implement, released under an open source licence, and provides a simple strategy to add stability to simulations undergoing large deformations.

MSC:

74S05 Finite element methods applied to problems in solid mechanics
74B20 Nonlinear elasticity
65N50 Mesh generation, refinement, and adaptive methods for boundary value problems involving PDEs

Keywords:

history-dependent remeshing variable; transfer technique; large elastic deformation; mesh distorsion

Full Text: DOI arXiv

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