

# **Mechanical Modeling of Thrust Faulting and Large Deformation Folding in Sedimentary Rock Strata**

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Abstract

Folding of sedimentary rocks could occur due to buckling associated with lateral tectonic compression and slip on thrust faults in the underlying strata. Movements experienced by folded layers are typically very large and could include considerable rigid body rotation and translation, significant straining, and substantial relative slip at the interface between rock layers. In this work we present a mechanical model to study the interaction between thrust faults and folds experiencing large deformations and discontinuities in the displacement field. We simulate the rigid body translation and finite rotation with nonlinear kinematics; the response of the rock layers with a three-invariant elastoplastic constitutive law; and the rupturing and evolution of preexisting faults as well as relative slip at the interface of folding layers using finite deformation frictional contact mechanics. Our numerical implementation is fully Lagrangian in a finite element framework. We apply the technique to simulate two- and three-dimensional faulting and folding of selected case studies. This work enables us to track the evolution of the stress state and the discontinuities throughout the deformation process, and to investigate the relationship between folded shapes and fault configurations.

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