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Numerical simulations of parasitic folding and strain distribution in multilayer systems

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To simulate slow viscous (Newtonian) flow in two dimensions without gravity and to model asymmetric (S- and Z-shaped) and symmetric (M-shaped) parasitic folds during multilayer folding the finite element method is used. Finite and incremental strain ellipses are calculated with the numerical results and visualized. During multilayer folding, the matrix between stiffer layers shows a deformation close to pure shear in the hinge area and a combination of pure and simple shear in the limb areas. Thinner layers placed between thicker layers develop symmetric parasitic folds in the hinge, and eventually asymmetric parasitic folds in the limbs of the larger fold. Asymmetric parasitic folds develop from symmetric buckle-folds that are sheared by the hinge-ward relative displacement of the thick layers in the limbs of the first-order fold. To develop asymmetric shapes, the amplitudes of the parasitic folds must exceed a critical value before the first-order fold begins to amplify. Otherwise the parasitic folds are unfolded during flattening that takes place in the limb area between the thick layers with increasing amplification. More than five thin layers are necessary to generate distinct asymmetric parasitic folds for the applied model setting. More layers generate higher amplification rates in the thin layers and, hence, higher amplitudes.