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Numerical modelling of torn boudinage

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The seminal text book by J.G. Ramsay outlines the importance of the progressive development of torn boudinage structures because the shape of boudins may vary greatly and is mainly dependent on the viscosity contrast between the more competent layer and the enclosing material and the values of the principal extensions of the finite strain ellipsoid. In this work we demonstrate that another parameter, the initial boudin separation, has a significant influence on the progressive development of the finite boudin shape.
We use finite element simulations to study the shape evolution of torn boudins under pure and simple shear. The boudins are initially rectangular and the gaps between them are prescribed. The boudin interfaces are resolved with high-resolution, body-fitting, unstructured computational meshes and a second-order ODE integrator is used to ensure the numerical accuracy of the results. Both the boudins and the host are treated as either linear or non-linear viscous fluids. We neglect any recrystallization processes and the boudin interfaces are considered as fully coherent.
We were able to reproduce the typical shape of fish-mouth boudins for a wide range of viscosity ratios between the highly viscous boudins and the host. We have systematically studied the effects due to the boudin-host viscosity ratio and the fluid stress exponents. Our results show that the initial separation can have a profound effect on the final shape of the boudins and we document the formation of hitherto undescribed complex boudin shapes for an initially narrow gap width.