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Analytical dike models in viscoelastic media

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Previously obtained analytical expressions for the displacement and stress field generated by elastic dislocations in layered media have been generalised to viscoelastic media. We derived solutions for tensile dislocations embedded in a medium composed by two half-spaces with different elastic and viscoelastic parameters. Maxwell rheology has been employed.

Integrating the obtained analytic kernels and imposing a time-constant stress-drop on crack plane, we model fluid-filled pressurised fractures.

The analysis of the resulting stress maps, plotted for different times and different ratios between elastic parameters, evidences the evolution of elastic stress concentrations in proximity of layer interfaces.

The stress intensity factor is also plotted as a function of time, showing that rheology has strong influences on the stability of fluid-filled fractures. Rheologic discontinuities in the media surrounding intruded magma batches may promote dike migration even in absence of other contributes as buoyancy.