

# Benchmark 3 - OLD

## Benchmark 3

Viscoelastic relaxation of stresses resulting from an imposed simple shear strain. No body forces are imposed.

*Benchmark 3a:* Solve using a Maxwell viscoelastic material rheology

*Benchmark 3b:* Solve using a Burger's body rheological description

*Benchmark 3c:* Solve using a power-law material description

## GOALS

- Test relevant constitutive relations
- Verify timing of output in specific codes (i.e., is output written at the beginning or end of the step).

## DETAILED DESCRIPTION

- Model size: 24 km by 24 km by 24 km (0 km  $\leq$  x; y  $\leq$  24 km; -24 km  $\leq$  z  $\leq$  0 km)
- Elastic material properties: Poisson solid,  $G = 30$  GPa
- Maxwell viscoelastic material properties:  $\eta = 10^{18}$  Pa-s
- Burger's body material properties: Maxwell element as above, Kelvin-Voigt element has  $G_{KV} = 10$  GPa,  $\eta_M = 10^{17}$  Pa-s
- Power-law material properties:  $\eta_{ref} = 10^{18}$  Pa-s and  $\sigma_{ref} = 10^5$  Pa. (Note: This value is chosen because the maximum initial elastic stress is of order  $10^6$  Pa; although all of that is deviatoric, the deviatoric stress decreases with time.)
- Density and Gravity: None
- Boundary conditions: Bottom pinned  
Sides pinned in y and z; free in x  
Top pinned in y and z; 1 m of displacement imposed in x
- Coarse mesh node spacing:  $dx = dy = dz = 2$  km

## ESTED OUTPUT AND RESULTS

Variations: As memory, time, and patience allow, run models at 1/2, 1/4, and 1/8, etc. the original coarse spacing, investigate variable mesh spacing, and/or employ a variety of element types.

Benchmark Variations:

Stresses along a path through (0,0,-24) and (24,24,0) at  $t = 0, 1, 5,$  and 10 years.

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Displacements along a path through (0,0,-24) and (24,24,0) at  $t = 0, 1, 5,$  and 10 years.  
CPU time, wallclock time, memory usage info, compiler info, and platform info

Results for each material rheology will be posted at [geoweb.mit.edu/fe](http://geoweb.mit.edu/fe).

## NOTES