12.521 COMPUTATIONAL GEODYNAMICS MODELING
Homework Assignment 4 –
3D faults
Due: Monday, December 14, 1998

Calculate displacement and stress fieldsof a 3D fault using the "GENPro 2.0.1 b" program. You can work with either (1) an inclined blind thrust fault,or (2) a vertical right-lateral strike-slip fault (only one case isrequired). Example input files for these two cases are contained in"class.exam1.thrust.in" and "class.exam1.rt-lat.in", respectively. Inboth cases, we assume that the faulted halfspace is linear elastic, E = Young's modulus in halfspace = 8×10^5 bars, and υ = Poisson's ratio in halfspace = 0.25.

(1) Blind thrust fault:

The geometry of the blind thrust fault in "class.exam1.thrust.in" is similar to that of homeworkassignment #3. Using the input parameters as given, illustrate thefollowing quantities:

(a) Calculate vertical displacement Uz andhorizontal displacements Ux, Uy at the ground surface. To calculatedisplacement and stress quantities at the ground surface, you must specify DEPTH = 0.0 km in the input file. (DEPTH was set to 1.150 kmwhen the file was given to you). What is the value of maximum verticaldisplacement at the ground surface and where is it located?

(b, optional) Make two cross-sections of stresses across the fault withone at the fault mid-point (y = 0 km) and the other near the fault end(y = 18 km). You can display any stress quantities of your choice(e.g., Coulomb failure stresses in optimal thrust or strike-slip modes). If you want to display σ_{xx}, σ_{zz}, σ_{xz}, etc., you willneed to choose the "Coulomb 3D" option under the"Functions" menu bar (be aware of output file size). How does the cross-sectionalstress pattern at the fault mid-point differ from that near the faultend?

(2) Right-lateral strike-slipfault:

Retain most of the fault geometric parameters asspecified in "class.exam1.rt-lat.in", but changethe fault "top' and "bottom" to 0and 10 km, respectively.

(a) Calculate horizontal displacements Ux, Uy at the ground surface. To calculate quantities at the ground surface, you must specify DEPTH = 0.0 kmin the input file. (DEPTH was set to 1.150 km when the file was givento you). What is the value of maximum horizontal displacement at theground surface and where is it located?

(b, optional) Make two map view sections of stresses with one near theground surface (DEPTH = 0.0 km) and the other at the fault mid-depth(DEPTH = 5.0 km). You can display any stress quantities of your choice(e.g., Coulomb failure stresses in optimal thrust or strike-slip modes). If you want to display σ_{xx}, σ_{zz}, σ_{xz}, etc., you willneed to choose the "Coulomb 3D" option under the"Functions" menu bar bar (be aware of output file size). How do the stresspatterns in these two map view sections differ?