JPE2605H Advanced Seismology (2010-2011)
PS 1

January 21, 2021

PS 1 is due on Feb 3rd, 11:59 pm to liuqy@physics.utoronto.ca

1 Comprehension questions

1. What geophysical parameters make up the Earth model when the isotropic (or anisotropic, or viscoelastic) wave equation is used?
2. Explain qualitatively the physical model for an earthquake point source. What parameters would you expect to be in a source-related file that initializes an earthquake simulation?
3. What boundary conditions are relevant for seismic simulation problems? Give examples.

2 Theoretical questions

1. Inject the trial solution $p(x, t) = p_0 e^{i(kx-\omega t)}$ into the source-free 1D acoustic wave equation $\partial_t^2 p = c^2 \partial_x^2 p$. Discuss the solution.
2. The 2003 Hokkaido earthquake (M8.1) led to a maximum horizontal displacement of 1.5 cm for Love waves for an approximately 25-second period recorded in Germany. Estimate the maximum dynamic strain induced by the passing wavefield for a horizontal phase velocity of 5 km/s.
3. What is the ratio between maximum S- and maximum P-wave amplitudes in the far field of a homogeneous medium for a double-couple point source? Use Eq. 2.41 and discuss implications for engineering seismology.
4. Estimate the difference of arrival times for Love and Rayleigh waves propagating at various periods [T=50s, T=200s] to a distance of 10,000 km. Refer to Fig. 2.22.

3 Computer exercises

1. Plot the 3D radiation patterns, A^{FP} and A^{FS}, for P and S far-field energy in Eq. 2.41.
2. Write a computer program that initializes a random 2D velocity perturbation by spatially low-pass filtering random numbers using transform methods.