Term Project #2 – Numerical Methods: Wavenumber Integration and Parabolic Equation

During the course, there were homework problems on ray and mode numerical methods, but none on wavenumber integration or PE. These latter two are a bit more time intensive to implement, and so are more on the order of a project. Luckily, COA has provided "simple recipe" appendices to the chapters on WI and PE, so that we can use them as guides.

1) Wavenumber Integration – There is a nice step-by-step recipe in Appendix 1 of Chapter 4 of COA. The first part of the Appendix, on the depth dependent Greens function, is the more complex, and if you want to abbreviate this project, just uses the "isovelocity water/ layered bottom" form for $g(k_r, z, z_0)$ we developed in the class notes. You will need R_B for this; if you choose the Rayleigh reflection coefficient, you will get the Pekeris waveguide, which you can compare to our class notes.

   The second part of Appendix 1 in COA Chapter 4 is the Fast Field Program part, which is a bit simpler. In this part, one uses the Greens function from the previous part, and performs the FFP transform (an FFT), which gives the complex pressure.

   Note that there is latitude in the waveguide parameters you use. Again, this is a bit of "creative playtime."

2) Parabolic Equation – Appendix 1 of Chapter 6 of COA has, again, a nice step-by-step recipe for how to create a small code. In this case, it is a small angle, marching algorithm code, which was the original form of the PE historically. As before, you choose the waveguide parameters. As a thought, $c(z) = c_0 \cosh(bz)$ produces perfect focusing points in range (see Frisk), which might make a nice test.