13.853 Computational Ocean Acoustics
Homework #4
Assigned: Session 13
Due: Session 17

Problem 1

This homework will complete the MATLAB wavenumber integration program we have been building in the first 3 homework sets.

1. Make a function for integrating the depth-dependent kernel computed by either the DGM or Propagator Matrix codes you constructed earlier, using the FFP approximation and an FFT. Let your code perform the integration along a complex horizontal wavenumber contour, $k_r = k_r(1 - i\delta)$. The source and receivers may be present in any of the layers and halfspaces.

2. Make a function for using this algorithm to compute transmission loss versus range and plot it in the standard format.

3. Use your code to reproduce the result shown by the solid curve in Fig. 4.5 of COA, shown on the next page.

4. Investigate the convergence with varying integration interval truncation. Describe any remedies you apply to speed up convergence.

5. Repeat the convergence analysis for a receiver at depth 35 m.

6. With a fixed complex contour, investigate the convergence of the integration with the number of wavenumber samples.

7. Compare your FFP code to an exact Hankel transform evaluation (e.g. using a built-in Bessel function generator and a trapezoidal rule integration for receivers at ranges shorter than 1 km for the same problem.