13.853 Computational Ocean Acoustics
Homework #5
Assigned: Session 17
Due: Session 20

Problem 1

In the following weeks we will build a normal mode code for shallow and deep water waveguides. To initiate this, perform the following tasks:

a. Add a capability of specifying a Munk sound velocity profile (SVP) with variable depth, and sound axis depth and speed to your MATLAB user interface.

b. Derive a finite difference representation of the boundary condition for a normal mode at the interface between two fluid media with different sound velocity and density. Assume the discretization intervals to be different, h_1 and h_2.

c. Assuming a finite difference discretization is truncated at the lowermost interface in the stratification, derive a finite difference representation for the boundary condition between a sediment and a fluid halfspace.

d. For a 3-layer ocean model, with a water column with arbitrary SVP, a sediment layer with arbitrary SVP and density profile, and a subbottom fluid halfspace, write MATLAB code for setting up a finite difference representation of the modal equation for uniform discretization intervals, h_1 in the water column and h_2 in the sediment. Allow for attenuation in the sediment and subbottom.

e. Store the global finite difference equations in a banded matrix form. What is the bandwidth?