Introduction to acoustical oceanography- Lab 4: scattering from a sphere, a computer lab.

Emmanuel Boss & Mick Peterson, Fall 2005.

The purpose of this part of the lab is to get you familiar with Anderson's (1950) and Faran's solutions for acoustic scattering from a sphere. Anderson's model is designed for a fluid sphere but neglects shear waves, viscous and thermal losses. Faran's model includes shear waves and is designed to deal with solid spheres.

Open matlab and change directory to Lab_6 (on your desktop).
Open the program anderson_EB.m and get familiar with its syntax.

- Use code from within the program validation_EB.m which uses Anderson's model to generate the form function for a bubble (c~300m/s, ρ~1kg/m^3) as function of ka and (for given ka's) its angular distribution.

- Modify your program to solve for a zooplankton (Euphausiid, E. Pacifica, Johnson, 1977), g~1.038 and h~1.033.

- Modify your program to solve for a 'rigid' particle, $\rho/\rho_{water}>>1$and $c/c_{water}>>1$.

Open the program faran.m and get familiar with its syntax.

Use code from within the program go_validate.m which uses faran's model to generate the form function of an aluminium ball (c~6420m/s, ρ~2700kg/m^3, poison ratio~0.355) ball as function of ka and the angular distribution for given ka's.
How would you convert your output to target strength - TS?

Homework:
With respect to the lab you conducted last time:
Glass microsphere (Whitehouse scientific, GP0083):
Size~75-90μm
Poisson ration~ 0.21
Specific gravity 2.46 g/cm3
Compressional Sound speed – 5292m/s
Shear velocity - 3469 m/s

1. Using the models, plot the acoustical form function squared ($|f_\infty|^2$) and the squared reflectivity at 25degrees ($|R(25)|^2$) as function of bead size for particles size of 1→1000 μm and a source of 16MHz. Are they different? (see go_validate.m for an example on how to run the faran.m model).
2. Plot the 'sensitivity' (acoustic cross section/volume of sphere) as function of size. Which size has the highest 'sensitivity'? What is its ka?