ACOUSTICS2008/2990
Scattering of a buried circular membrane imbedded in a rigid substrate in a layered fluid waveguide

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A study of mathematical modeling of the buried landmine detection problem involves wave propagation in a layered waveguide in the presence of a flush mount buried circular target. In this study, emphasis is placed on acoustic to seismic coupling of an airborne CW point source located over an iso-velocity fluid layer. The top plate of the buried landmine is modeled as a circular elastic membrane stretched flush over a cylindrical cavity in a rigid substrate beneath the fluid layer. The finite fluid layer affords a manageable study of the modal resonances in the waveguide system with and without the target. The Helmholtz equation is solved in the atmospheric layer using cylindrical coordinates and a point source. The homogeneous Helmholtz equation is used in the fluid layer. Green's function techniques involving vibrations of the membrane are incorporated into the boundary conditions. Results of the closed form normal mode solution will be presented in a MATLAB^{TM} user interface; describing the effects of frequency, depth, density, sound, absorption, including radius and elastic parameters of the membrane. Comparison of the results (involving the fluid surface particle velocity profiles across the target) will be made with experiments reported in the literature to evaluate its usefulness.