

Example Paper #1 from Spring 2005

I feel that one of the most interesting seminars given was by Kirk Blazek. Kirk definitely made the seminar more interesting with his frequent jokes and his application of mathematics to the real world. Kirk dubbed his speech *Blowing Stuff Up and Looking for Oil in Silly Putty: The One Dimensional Seismic Inverse Problem for Viscoelastic Media*. This is just a funny way of saying that these researchers set off explosions on the surface of the earth and record the data being sent back up to the surface and based on that data, they determine what material the earth is made of at that point. More importantly they are interested in finding new sources for oil.

This problem is modeled after the vocal-tract problem, which is based on the sounds humans make and an attempt to recover the shape of the vocal tract based on those specific sounds recorded. Kirk went on to explain the process by which he manipulates the PDEs which involve the density of the material ρ , and the speed of sound c . The variables ρ and c are functions of depth. The equations also involved the particle velocity $w(z,t)$, and pressure $p(z,t)$. Kirk explained how these equations consider the earth to be perfectly elastic, therefore he must change one of the equations to portray the earth's ground as viscoelastic.

The important piece to this crazy group of equations is the impulse response equations. These are $p(0,t) = \delta(t)$ and $w(0,t) = h(t)$ where $h(t)$ is what is read at seismographs. What Kirk said he is interested in is finding the inverse problem, which is if we know h , what is ζ ? As much as I love trying to write out the asymptotic expansion of the PDEs Kirk derived early in the lecture, I will leave them out. I found the entire speech very interesting and down to earth (aside from a few of the equations I am not too familiar with). I would definitely recommend that Kirk do a follow up information session with a little more depth into the actual schematics of how the explosions are set off and retrieved.