Self Introduction and Project Description

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Self Introduction

- NAME: Sichao Chen

- EDUCATION:
  - Bachelor: *Dept. of Mathematics, Peking University, Beijing, China.*
  - Currently I am a graduate student of CAAM Dept., Rice University.

    Advisor: Dr. William W. Symes.

- ACADEMIC BACKGROUND:
  - In Peking University, I had some research experiences on PDE (applied in forestry) and Algebra (CDMA coding);
  - Currently I am studying the one dimensional inverse problem.

Project Description (One Dimensional)

- OUR AIMS: to recover the velocity $c(\tau)$ (τ is the *depth*) from the known data (*surface response*) $u(0,t)$.

- Inverse problem can be viewed as a *Forward Map* problem: solve c from $F(c) = u(0,t)$.

- Make some small equivalent change to c and $u(0,t)$: let $\sigma(\tau) = \frac{\partial}{\partial \tau}\left(\log \frac{1}{\rho(\tau)c(\tau)}\right)$ and let $u_t(0,t)$ represents function $u(0,t)$, then we have the forward map: $F : \sigma \to u_t(0,t)$.

- *How disturbance affect our result*: we can look at the *Linearized Forward Map* $\frac{\mathrm{d}F}{\mathrm{d}\sigma}$. For $c \equiv 1$ with initial condition $u_\tau(0,t) = f$ we get:

$$\frac{\mathrm{d}F}{\mathrm{d}\sigma} = \frac{1}{2}\int_{\mathbb{R}} f(t')\sigma\left(\frac{t-t'}{2}\right)\,\mathrm{d}t'.$$

  For general $c(\tau)$, something similar but more complicated.

- FUTURE WORK: Solve some multi-dimensional layered medium inverse problem using the results from one dimensional case.

Currently Reading...

- P. Sack and F. Santosa, *A Simple Computational Scheme for Determining the Sound Speed of An Acoustic Medium From Its Surface Impulse Response*, SIMA J. Sci. Stat. Comput., Vol 8, No.4, p.501 - 520;
- F. G. Friedlander, *Sound Pulses*, Cambridge University Press, 1958;
- William W. Symes, *Layered Velocity Inversion: A Model Problem from Reflection Seismology*, SIAM J. Math. Anal, Vol. 22, No.3, p.680 - 716.