Notes on: Full-wavefield focusing in seismic imaging – Concepts, applications, and examples[1]

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Physics and math cheat-sheet for anyone who doesn't need it.

[1] Space for Notes

Impulse response

A finite pulse infinitely short in time is usually denoted as $\delta(t)$. [1]

Greens Functions

The Greens function $\mathbf{G}(x, x_a, t)$ is the impulse response at point x of a source at point x_a. [2]

Source-Receiver Reciprocity

$\hat{\mathbf{G}}(x_B, x_A, \omega) = \hat{\mathbf{G}}(x_A, x_B, \omega)$ means that we can switch the responses of x_A and x_B. [2]

Seismic Interferometry (simplest form)

$\mathbf{G}(x_B, x_A, t) = \mathbf{G}(x_B, x_S, t) * \mathbf{G}(x_A, x_S, -t)$ says that the response at x_B from x_A is also described as the crosscorrelation of the responses at these receivers from a source x_S. [3]

Inversion by (von) Neumann Series

If a matrix $\mathbf{A}$ has the property that $\lim_{n\to\infty}(\mathbf{I} - \mathbf{A})^n = 0$ then $\mathbf{A}$ is non-singular and its inverse may be expressed by a Neumann series: $\mathbf{A}^{-1} = \sum_{n=0}^{\infty}(\mathbf{I} - \mathbf{A})^n$. (CC-BY-SA Wikipedia:Invertible_matrix) [4]

Born Approximation

Separates the elastic wave equation into scalar and vector fields. Then we look at the scalar field and make use of single point scatterers. [5]

Marchenko imaging

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[2] Main topic of talk. Read backwards for spoilers.

[3] Like this? Also check out https://the-geophysicist.com

References

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[4] Gilbert W.. Stewart. *Matrix Algorithms: Basic Decompositions*. SIAM, Society for industrial and applied mathematics, 1998.

[5] JA Hudson and JR Heritage. The use of the born approximation in seismic scattering problems. *Geophysical Journal International*, 66(1):221–240, 1981.

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