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Depth sounding: An illustration of some of the pitfalls of inverse scattering problems. (English) [Zbl 1109.62367](#)

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Summary: The principal objective of this work is to show how various "connections" between the estimator and the predictor affect the solution of an inverse scattering problem as it is formulated in the frequency domain. We show that when there is little or no connection, it is impossible to obtain a solution. The other extreme, i.e., identity of the estimator and predictor, enables solutions to be obtained, whatever the particular choices of the estimator or predictor, but these solutions are not trivial, as is written by *D. Colton* and *R. Kress*, *Inverse acoustic and electromagnetic scattering theory*. 2nd ed. (1998; [Zbl 0893.35138](#)), in that they are not unique. Moreover, we show that by a suitable change of external variables (e.g., frequency), one can lift the degeneracy and thereby spot the correct solution, which is unique. In this respect, the inverse crime turns out to be useful in that it enables one to devise methods for resolving the nonuniqueness issue of inverse problems. More generally, we show that successful inversion, in both the frequency and time domains, can be accomplished only when the discrepancy between the estimator and the predictor is small.

MSC:

[62P35](#) Applications of statistics to physics
[62P99](#) Applications of statistics
[35R30](#) Inverse problems for PDEs

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Keywords:

[Inverse scattering problem](#); [Unique solution](#); [Estimator](#); [Predictor](#); [Frequency](#); [domain](#); [Time domain](#); [Cost functional](#)

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