# Imaging of discontinuities in the inverse scattering problem by inversion

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verse" GRT. Due to the nature of the asymptotics we are able to give a precise meaning to what is reconstructed by this first-order inversion for arbitrary configurations of sources and receivers, including the case of limited view an- [redacted]

we linearize the relation between the function $v^{sc}$ and the perturbation $L_1$.

Let us now apply this procedure to the Helmholtz equation which describes wave propagation in a fluid of constant [redacted] mate solution of (2.6) we use, in place of (2.4), the first term of [redacted]

responding transport equations along the rays connecting [redacted]

[redacted]

$\partial X^0_\eta(y) = \partial X \setminus \partial X_\eta(y).$

To describe $\partial X_\eta(y)$ and, therefore, $\partial X^0_\eta(y)$ for a given interior point $y \in X$, three cases can be distinguished.

(1) $\hat{n}(y) > \tilde{n}(y)$. In this case $\partial X_\eta(y)$ is empty since $\epsilon$ can [redacted]

we find that

$$dp = k^{n-1} h(y,\xi) d\xi \, dk, \tag{4.16}$$

and, thereby,

[redacted]

$$C_\Phi = \{(k,\xi,x,y) \in R_+ \times \partial X^0_\eta(y) \times X \times X : \Phi(x,y,\xi) = 0,$$
$$\nabla_\xi \Phi(x,y,\xi) = 0\}. \qquad (4.21)$$

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$F$ of the form in (4.27) consists of increasingly smooth pseudodifferential operators. Comparing the first term in the ex-

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Again, consider the Fourier integral operator $F$

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where $v(k,\xi,\eta)$ is described in (3.1). In many cases of practical

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where the bar denotes the complex conjugate. In particular, this relation shows that the Fourier space is covered twice if $\partial X^0 = \partial X$. Given the source-receiver configuration of a particular experiment, we can determine the domain in the Fourier space where the function $f^\wedge$ is known. This domain controls the spatial resolution of the reconstruction. In examples where the domain $X$ is a half-space (given later in this section) we only have partial coverage since observation points are restricted to the boundary of the half-space. How-

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where $\bar{l}$ and $\bar{l}_0$ are unit vectors pointing in the direction of $x_n$ axis and in the direction of the line connecting points $x$ and $\eta$. The generalized backprojection operator $R^*$ thus is

$$(R^*w)(x) = C_n \int_{\partial X} w(2|x-\eta|,\eta)\bar{l}\cdot\bar{l}_0\, d\eta, \tag{6.9}$$

where $w$ is given in (6.2) or (6.3) depending on the dimension n. Here we integrate over all source-receiver positions on the boundary $\partial X$. The GBO in (6.9) can be considered as a mi-

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$$\phi_{x_1} = \frac{x_1 - \eta - d}{\ldots} + \frac{x_1 - \eta + d}{\ldots},$$

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(with the preservation of orientation) to the unit sphere $S_x^{n-1}$

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[redacted]