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IMAGING EXTENDED REFLECTORS IN A TERMINATING WAVEGUIDE

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We consider the problem of imaging extended reflectors in a terminating waveguide $\Omega \subset \mathbb{R}^2$ that consists of two subdomains: a semi-infinite strip $\Omega_{L^-} = (-\infty, L) \times (0, D)$ and a bounded domain Ω_{L^+}. We assume that the medium is homogeneous in Ω_{L^-}, while it can be inhomogeneous in Ω_{L^+}, which may also contain the reflector to be imaged.

We introduce an imaging functional that relies on the back-propagation of a modal projection of the array response matrix. The projection is adequately defined for any array aperture size that covers fully or partially the waveguide's vertical cross-section. A resolution analysis of the proposed imaging method shows that the resolution of the image is determined by the central frequency, while the signal-to-noise ratio improves as the the bandwidth increases.

The resulting images provide reconstructions that allow us to recover the reflector's location, size and shape with very good accuracy. Moreover, as one may intuitively expect, in the terminating waveguide we benefit from the reflections (multiple-scattering paths) that bounce off the terminating boundary of the waveguide, thus providing views of the reflector that are not available in an infinite waveguide.

The robustness of the imaging method is assessed with fully non-linear scattering data in terminating waveguides with complex geometries.

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