

# AN INVERSE SOURCE PROBLEM FOR A VARIABLE SPEED WAVE EQUATION WITH DISCRETE-IN-TIME SOURCES

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ABSTRACT. We consider a time-dependent inverse source problem for the inhomogeneous wave equation, with sources that are delta-like in time, and (roughly speaking) non-negative and of limited oscillation in space. We take the displacement of the wave on a fixed detection surface, over some time interval, as our data. We then use time-reversal from the boundary to generate a related waveform, and discuss how to identify sources (as well as artifacts) from this.

This has application to seismic imaging; in particular, the recovery of the properties of earthquake ruptures, where the sources correspond to several seismic events occurring close together in space and time, and the resulting waves are measured by remote sensing stations. Another application is to microseismic monitoring of hydraulic fracturing, where fractures are detected by triggering small micro-earthquakes.

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*Key words and phrases.* inverse problems, wave equation, geophysical imaging, seismic imaging, thermoacoustic tomography.

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