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Recovering both the wave speed and the source function in a time-domain wave equation by injecting high contrast bubbles

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Dealing with the inverse source problem for the scalar wave equation, we have shown recently that we can reconstruct the spacetime dependent source function from the measurement of the wave, collected on a single point x and a large enough interval of time, generated by a small scaled bubble, enjoying large contrasts of its bulk modulus, injected inside the domain to image. Here, we extend this result to reconstruct not only the source function but also the variable wave speed. Indeed, from the measured waves, we first localize the internal values of the travel time function by looking at the behavior of this collected wave in terms of time. Then from the Eikonal equation, we recover the wave speed. Second, we recover the internal values of the wave generated only by the background (in the absence of the small particles) from the same measured data by inverting a Volterra integral operator of the second kind. From this reconstructed wave, we recover the source function at the expense of a numerical differentiation.

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