

## Accepted Manuscript

A numerical study of super-resolution through fast 3d wideband algorithm for scattering in highly-heterogeneous media

Pierre-David Létourneau, Ying Wu, George Papanicolaou,  
Josselin Garnier, Eric Darve

PII: S0165-2125(16)30113-5

DOI: <http://dx.doi.org/10.1016/j.wavemoti.2016.08.012>

Reference: WAMOT 2099

To appear in: *Wave Motion*

Received date: 1 May 2016

Revised date: 22 August 2016

Accepted date: 27 August 2016



Please cite this article as: P.-D. Létourneau, Y. Wu, G. Papanicolaou, J. Garnier, E. Darve, A numerical study of super-resolution through fast 3d wideband algorithm for scattering in highly-heterogeneous media, *Wave Motion* (2016), <http://dx.doi.org/10.1016/j.wavemoti.2016.08.012>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# A Numerical Study of Super-Resolution through Fast 3D Wideband Algorithm for Scattering in Highly-Heterogeneous Media

Pierre-David Létourneau<sup>a</sup> Ying Wu<sup>b</sup> George Papanicolaou<sup>c</sup>  
Josselin Garnier<sup>d</sup> Eric Darve<sup>e,f</sup>

<sup>a</sup>*Reservoir Labs, New York City, NY*

<sup>b</sup>*Division of Computer, Electrical and Mathematical Science and Engineering, King Abdullah  
University of Science and Technology, Thuwal, 23955-2900, Saudi Arabia*

<sup>c</sup>*Department of Mathematics, Stanford University*

<sup>d</sup>*Laboratoire de Probabilités et Modèles Aléatoires, Université Paris Diderot, France*

<sup>e</sup>*Institute for Computational and Mathematical Engineering, Stanford University*

<sup>f</sup>*Mechanical Engineering Department, Stanford University, CA*

---

## Abstract

We present a wideband fast algorithm capable of accurately computing the full numerical solution of the problem of acoustic scattering of waves by multiple finite-sized bodies such as spherical scatterers in three dimensions. By full solution, we mean that no assumption (e.g. Rayleigh scattering, geometrical optics, weak scattering, Born single scattering, etc.) is necessary regarding the properties of the scatterers, their distribution or the background medium. The algorithm is also fast in the sense that it scales linearly with the number of unknowns. We use this algorithm to study the phenomenon of super-resolution in time-reversal refocusing in highly-scattering media recently observed experimentally [1], and provide numerical arguments towards the fact that such a phenomenon can be explained through a homogenization theory.

*Key words:* Fast multipole method, multiple scattering, waves in inhomogeneous media, super-resolution, homogenization.

---

\* The work described here was partially supported by King Abdullah University of Science and Technology.

\*\*The work described here was partially supported by the Army High Performance Computing Research Center (AHPARC) at Stanford University.

*Email address:* [letourneau@reservoir.com](mailto:letourneau@reservoir.com) (Pierre-David Létourneau).

Download English Version:

<https://daneshyari.com/en/article/5500544>

Download Persian Version:

<https://daneshyari.com/article/5500544>

[Daneshyari.com](https://daneshyari.com)