Adrien Semin

Postdoctoral Student

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Born on 5th April 1983

Education

10/2010-2012 **Postdoc in Applied mathematics**, *Foundation Of Research and Technology - Hellas (FORTH)*.

- **Subject:** Numerical Cross Correlation and passive sensor imaging
- **Keywords:** Imaging, wave propagation, random media, cross correlation.

  We consider imaging with passive arrays of sensors using as illumination ambient noise sources. The first step for imaging under such circumstances is the computation of the cross correlations of the recorded signals, which have attracted a lot of attention recently because of their numerous applications in seismic imaging, volcano monitoring, and petroleum prospecting. Here, we use these cross correlations for imaging reflectors with travel-time migration. While the resolution of the image obtained this way has been studied in detail, we concentrated on an analysis of the signal-to-noise ratio (SNR). It is shown that the SNR of the image inherits the SNR of the computed cross correlations and therefore it is proportional to the square root of the bandwidth of the noise sources times the recording time. Moreover, the SNR of the image is proportional to the array size. This means that the image can be stabilized by increasing the size of the array when the recorded signals are not of long duration, which is important in applications such as non-destructive testing.
- **Advisor:** Chrysoula Tsogka (FORTH and University of Crete) - tsogka@tem.uoc.gr
- funded by the project ADAPTIVES (ERC starting grant - `http://www.tem.uoc.gr/~tsogka/adaptives/index.html`

10/2007-09/2010 **PhD in Mathematics**, *University of Paris-Sud and INRIA Rocquencourt*, Defended in November 2010.

- **Subject:** Propagation of waves in junction of thin slots
- **Keywords:** Matched asymptotic expansion, singularities, Kirchhoff law, Helmholtz equation, wave equation, modelling, parallel computing.

  We consider here time harmonic or time domain wave propagation in thin domains that are junctions of thin slots whose thickness ε is small with respect to the wave length λ and converges, when ε tends to 0, to a 1-dimensional graph. Intuitively, one expects that the solution of the original model converges to a 1D function defined on the limit graph. The homogeneous Neuman boundary condition is considered. The limit model is known for a long time : the limit solution satisfies the 1D time harmonic (or time domain) wave equation and the so called Kirchoff conditions (in electricity) at each node of the graph. In this work, we derived matched asymptotic expansions to improve this limit model. We justified completely the matched asympotic expansion and error estimates, and we developped numerical methods to solve efficiently this problem.
- **Advisor:** Patrick Joly (INRIA Rocquencourt) - patrick.joly@inria.fr
- **Co-advisor:** Bertrand Maury (University of Paris XI) - bertrand.maury@math.u-psud.fr

2007 **MCs in Applied Mathematics**, *University of Paris-Sud*.

2005 **License in Mathematics and Informatics**, *University of Nîmes*.

Teaching experiences

Fall 2009 **Teaching assistant**, *University of Paris-Sud*.
Supervised student experiments on using the C language.

Fall 2008 **Teaching assistant**, *University of Paris-Sud*.
Supervised student experiments on using the C language.

Spring 2008 **Teaching assistant**, *University of Paris-Sud*.
Supervised student experiments on using the Matlab language.

Skills

Informatics

C++ Worked on many C++ projects. The most importants are:
- developments inside the software Montjoie (`http://gforge.inria.fr/projects/montjoie`),
- co-authored the software Netwaves (`http://gforge.inria.fr/projects/netwaves`),
- adapted chemical library into the Life-V code for reactive transport in porous media (`https://gforge.inria.fr/projects/lifev-chemical/`).

Parallel computing: Knowledge on OpenMP, MPI and CUDA

Web-based language: XHTML/CSS, PHP, MySQL, SQL Server, Javascript

Other languages: LaTeX, Java, Ruby

Operating systems: Linux (former administrator of the team POems at INRIA Rocquencourt - France), Mac OS X (experience includes Snow Leopard and parallel programming), Windows (experience includes parallel computing and GPU computing)

Languages

French **Mothertongue**

English **Written and spoken**

German **Notions**

Greek **Notions**

Reference persons

Patrick Joly: Team Leader of EPI POems, INRIA Rocquencourt, patrick.joly@inria.fr

Houssem Haddar: Team Leader of EPI DeFI, CMAP, Ecole Polytechnique, houssem.haddar@inria.fr

Chrysoula Tsogka: Associate Professor, University of Crete, tsogka@tem.uoc.gr

Serge Nicaise: Professor at University of Valenciennes, snicaise@univ-valenciennes.fr

Bibliography

Publications

[J5] J. Garnier, G. Papanicolaou, A. Semin and C. Tsogka, **Signal to Noise Ratio estimation in passive correlation-based imaging**, SIAM Journal on Imaging Sciences, Volume 6, Issue 2, pp. 1092-1110, June 2013.

[J4] P. Joly, A. Semin, **Mathematical and numerical modelling of wave propagation in fractal trees**, Comptes-Rendus de l'Académie des Sciences de Paris, Ser. 1 (2011)

[J3] A. Semin, **Propagation of acoustic waves in fractal networks**, Oberwolfach Report, vol. 10, pp. 86-89, 2010.

[J2] J.B. Apoung, P. Havé, J.G. Houot, M. Kern and A. Semin, **Reactive Transport in Porous Media**, ESAIM Proceedings, vol. 28, pp. 227-245, November 2009.

[J1] P. Joly and A. Semin, **Construction and analysis of improved Kirchoff conditions for acoustic wave propagation in a junction of thin slots**, ESAIM Proceedings, vol. 25, pp. 44-67, December 2008.

Research reports

[R2] P. Joly and A. Semin, **Study of propagation of acoustic waves in junction of thin slots**, INRIA Research Report, vol. RR-7265, pp. R1-R59, April 2010.

[R1] P. Joly and A. Semin, **Propagation of an acoustic wave in a junction of two thin slots**, INRIA Research Report, vol. RR-6078, pp. R1-R61, October 2008.

PhD Thesis

[Th1] A. Semin, **Propogation of acoustic waves in junctions of thins slots.** Ph.D. Thesis, University of Paris-Sud Xi, France, November 2010.

Publications in preparation

[Pr3] P. Joly and A. Semin, *Study of the Helmholtz equation in a fractal network*, in preparation, 2012

[Pr2] P. Joly and A. Semin, *Propagation of acoustic waves in a junction of 3D slots*, in preparation, 2012

[Pr1] S. Nicaise and A. Semin, *Density of compactly supported function in generalized fractal networks*, in preparation, 2011

Talks

[T16] *Signal to noise ratio estimation in passive correlation based imaging*, ACMAC Workshop on Waves and imaging in complex media, June 2012

[T15] *Signal to noise ratio estimation in passive correlation based imaging*, ACMAC Workshop on Wave propagation in complex media and applications, May 2012

[T14] *Propagation of acoustic waves in infinite and fractal trees*, ACMAC Workshop on Wave propagation in complex media and applications, May 2012

[T13] *Coherent imaging using cross-correlations of ambient noise sources*, Vancouver, Canada, Conference "Waves 2011", July 2011

[T12] *Coherent imaging using cross-correlations of ambient noise sources*, ACMAC Workshop on Stochastic Partial Differential Equations, June 2011 [invited talk]

[T11] *Propagation d'ondes acoustiques dans des arbres infinis*, POems Seminar, Paris, May 2011 [invited talk]

[T10] *Wave propagation model in self-similar trees*, Bordeaux, CANUM 2010, June 2010

[T9] *Propagation of acoustic waves in junction of thin slots*, Berlin, 6th Singular Days, April-May 2010

[T8] *Propagation of acoustic waves in fractal networks*, Germany, Oberwolfach Seminar, February 2010 [invited talk]

[T7] *Construction and Analysis of Improved Kirchhoff Conditions for Acoustic Wave Propagation in a Junction of Thin Slots*, Pau, Conference "Waves 2009", June 2009

[T6] *Résolution de l'équation des ondes dans un réseau infini*, POems seminar, Paris, April 2009 [invited talk]

[T5] *Reactive Tranport in Porous Media*, INRIA Rocquencourt, OpenBANG Seminar, February 2009 [invited talk]

[T4] *Propagation of acoustic waves in junction of thin slots*, Marseille, CEMRACS 2008, July-August 2008

[T3] *Propagation d'ondes acoustiques dans des jonctions de fentes minces*, University of Paris XI, GTN, February 2008 [invited talk]

[T2] *Étude de la propagation des ondes dans des jonctions de fentes minces*, University of Montpellier II, ACSIOM Seminar, November 2007 [invited talk]

[T1] *Résolution de l'équation des ondes dans des jonctions de fentes minces*, INSA Toulouse, GMM Seminar, June 2007 [invited talk]