

## **CURRICULUM VITAE**

### **Eric Bonnetier**

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## **EDUCATION**

Ecole normale supérieure, Paris, 1983-1988

Ph.D. University of Maryland, 1988.

Habilitation à diriger les recherches, Janvier 2001.

## **PROFESSIONAL EXPERIENCE**

Aug. 1988 - Aug. 1989 : Commissariat à l'Énergie Atomique (military service).

Sept. 89 - Aug. 2002 : Chargé de recherche CNRS, Centre de Mathématiques Appliquées, Ecole Polytechnique, Palaiseau, France

Sept. 1995- Dec. 1996 : Visiting position at the Department of Mathematics, Rutgers University, USA

Since Sept. 2001 : Professor, Université Joseph Fourier, Grenoble.

## **RESEARCH INTERESTS**

Homogenization and composite materials.

Shape optimization and inverse problems.

Mean curvature flow and crystal growth.

## **CURRENT RESEARCH PROJECTS**

Pointwise bounds on the gradients of solutions to elliptic PDE's in composite media.

Detection of defects in composite media from boundary measurements. Application to impedance tomography by acoustic perturbation.

Asymptotic study of the diffractive properties of rough metallic surfaces.

Elastic instabilities in thin crystalline films. Numerical methods for the computation of equilibrium shapes.

## **CURRENT COLLABORATIONS:**

H. Ammari (Ecole Polytechnique-LOA ESPCI), Y. Capdeboscq (Oxford), F. Jouve (Ecole Polytechnique), F. Triki (LJK Grenoble).

M. Vogelius (Rutgers), A. Chambolle (Ecole Polytechnique), C. Conca (Universidad de Chile).

## **SERVICE TO THE COMMUNITY :**

Head of the department Modèles et Algorithmes Déterministes of Laboratoire Jean Kuntzmann (45 permanent members, 25 PhD students).

Chairman of the Master program in Applied Mathematics of Université Joseph Fourier.

Member of the program committee of ‘Dynamique des Systèmes Complexes’, a local interdisciplinary research group (<http://consoude.ujf-grenoble.fr/dysco2004/index.htm>).

Member of the hiring committees of Université de Nice, Université de Chambéry, Université de Clermont-Ferrand.

### **Program committees:**

Coordinator (with F. Jouve) of Optopo, optimisation de formes, Ecole Polytechnique (Oct. 97).

Organisation of a mini-symposium ‘surface and bulk effects in hetero-structures’, GAMM meeting (25–28 mars 2002, Augsburg).

Member of the organization committee and of the scientific committee of SMAI 2007, (the bi-annual meeting of the French Applied and Industrial Maths Society).

Organisation of a mini-symposium ‘Homogenization, inverse problems and shape optimization’, ICIAM 2007, Zurich.

Member of the scientific committee, Canum 2008.

Member of the scientific committee of WIPA 2010 Workshop on Inverse Problems and Application, Valparaiso, Chile, Jan. 18-22, 2010 (and CIMPA summer School in Santiago).

### **PROJECTS and CONTRACTS:**

Société Nationale des Poudres et Explosifs (SNPE, contrat # 2092, 1993-1994)

Coordinator of the cooperation project DGRST (Tunisie)-CNRS (projet 98/R1501), (thèse de F. Khayat, 1998-2001).

Coordinator (with M. Vogelius) of the CNRS/NSF project “Défauts, interfaces et couches limites dans les milieux composites” (projet 10669, 2001-2003).

Coordinator (with B. Bidegaray, LJK) of the project ‘Physique des Interactions Fines’ 2002-2004 (<http://www-lmc.imag.fr/lmc-edp/Brigitte.Bidegaray/PIF/index.html>).

Coordinator of the project ‘Elasticité et Nanostructures’, supported by the Région Rhône-Alpes (7 persons, 1 PhD student, 1 postdoc, 2003-2006).

Local coordinator at LJK, of the Echoscan project, supported by ANR (Agence Nationale de la Recherche, 2006-2009).

### AWARDS:

Cray Prize in scientific computing 1997, (with G. Allaire, S. Aubry and F. Jouve).

### INVITED COURSES:

Complejidad en diseño óptimo: microestructuras y microgeometrías, Universidad de Castilla-La Mancha, Ciudad Real, april 2008.

Homogénéisation des milieux composites en phases diluées et applications, Calais, Sept. 2009.

Detection of defects in composite media, International workshop Control and Inverse Problems, IISc IMI, Bangalore, Dec. 2009.

Asymptotic methods for the detection of small inhomogeneities from boundary measurements, CIMPA Summer School on Inverse Problems and its Applications, Santiago, Jan. 2010.

### PUBLICATIONS IN REFEREED JOURNALS

1. E. Bonnetier. *Plane stress elasto-plastic constitutive equations obtained by homogenizing one-dimensional structures*. RAIRO M2an, Vol. 29,1, 23-52, 1995.
2. E. Bonnetier et C. Conca. *Relaxation d'un problème d'optimisation de plaques*. C.R. Acad. Sci. Paris, t 317, Série I, pp. 931-936, 1993.
3. E. Bonnetier et C. Conca. *Approximation of Young measures by functions and application to a problem of optimal design for plates with variable thickness*. Proc. Royal Soc. Edinburgh, 124 A, 399-422, 1994.
4. G. Allaire, E. Bonnetier, G. Francfort et F. Jouve. *Shape optimization by the homogenization method*. Num. Math., Vol 76, pp. 27-68, 1997.
5. F. Béreux, E. Bonnetier et P.G. Lefloch. *Gas dynamics equations, 2 special cases*. SIAM J. Math. An., 28, 3, pp. 499-515, 1997.
6. E. Bonnetier et C. Conca. *Optimality conditions for a relaxed layout optimization problem*. C.R. Acad. Sci., Série I Math. 327, 1005-1010, 1998.
7. E. Bonnetier, R.S. Falk et M. Grinfeld. *Analysis of a One-dimensional Variational Model of the Equilibrium Shape of a Deformable Crystal*. M2AN, 33 (3), pp. 573-591, 1999.
8. E. Bonnetier et M. Vogelius, *An elliptic regularity result for a composite medium with "touching" fibers of circular cross-section*, SIAM J. Math. Analysis, 31, pp. 651-677, 2000.
9. G. Bao et E. Bonnetier, *Optimal Design of Periodic Diffractive Structures*, Appl. Math. Opt., 43, pp. 103-116, 2001.
10. H. Ammari, N. Béreux et E. Bonnetier. *Analysis of the radiation properties of a planar antenna on a photonic crystal substrate*. Math. Methods Appl. Sci., 24, pp. 1021-1042, 2001.
11. E. Bonnetier et A. Chambolle. *Computing the equilibrium shape of an elastic crystal*. SIAM J. Appl. Math., 62: 1093-1121, 2002.

12. F. Ben Hassen et E. Bonnetier *Asymptotic formulas for the voltage potential in a composite medium containing close or touching disks of small diameter*. SIAM MMS,4(1): 250-277, 2005.
13. E. Bonnetier et F. Khayat. *Influence of distorsion in the homogenization of fiber-reinforced composites*, M3AS **16**, # 11, 1861–1885, 2006.
14. F. Ben Hassen et E. Bonnetier. *An asymptotic formula for the voltage potential in a perturbed  $\varepsilon$ -periodic composite medium containing misplaced inclusions of size  $\varepsilon$* , Proc. Royal Soc. Edinburgh, 136 A, 669–700, 2006.
15. E. Bonnetier et S.G. Sista. *Asymptotics for the voltage potential in a periodic network with localized defects*, Math. Meth. Appl. Sci., 31 (10), 1175-1196, 2008.
16. H. Ammari, E. Bonnetier, Y. Capdeboscq, M. Tanter and M. Fink, *Impedance Tomography by Elastic Deformation*, SIAM J. Appl. Math., 68 (6), 1557-1573, 2008.
17. E. Bonnetier and F. Triki, *Asymptotics in the presence of inclusions of small volume for a conduction equation: A case with a non-smooth reference potential*, AMS, Contemporary Math. 494, 95-111, 2009.
18. E. Bonnetier, C. Misbah, F. Renard, R. Toussaint and J.P. Gratier, *Does roughening of rock-fluid-rock interfaces emerge from a stress-induced instability?* Eur. Phys. J. B, 67 (1), 121-131, 2009.
19. E. Bonnetier, D. Bresch and V. Milisic, *A priori convergence estimates for a rough Poisson-Dirichlet problem with natural vertical boundary conditions*, to appear, Advances in Math. Fluid Mechanics (2009).
20. H. Ammari, E. Bonnetier and Y. Capdeboscq, *Enhanced Resolution in Structured Media*, SIAM J. Appl. Math. 70 (5), 1428-1452, 2009.
21. E. Bonnetier, F. Triki, *Asymptotic of the Green function for the diffraction by a perfectly conducting plane perturbed by a sub-wavelength rectangular cavity*, to appear in Math. Meth. Appl. Sc., DOI: 10.1002/mma.1194, 2009.

## ARTICLES IN PREPARATION

1. J.F. Babadjian, E. Bonnetier and F. Triki, *Asymptotics of the electromagnetic fields in a domain containing two subwavelength rectangular cavities*, submitted, 2010.
2. E. Bonnetier, D. Manceau and F. Triki, *Asymptotics of a dilute suspension of droplets with interfacial tension*.
3. H. Ammari, E. Bonnetier, F. Triki and M. Vogelius, *An integral equation approach to  $C^{1,\alpha}$  elliptic regularity in composite material*.
4. E. Bonnetier, E. Bretin and A. Chambolle, *A spectral approximation method for anisotropic mean curvature flow*.

## PUBLICATIONS IN PROCEEDINGS

1. E. Bonnetier et M. Vogelius *Relaxation of a compliance functional for a*

*plate optimization problem*. Proceedings of the Conference on the Application of Multiple Scaling in Mechanics, P.G. Ciarlet and E. Sanchez Palencia eds, Masson, pp. 31-53, 1987.

**2.** E. Bonnetier, H. Jourdain et P. Veysseyre. *Un Modèle hyperélastique-plastique eulérien applicable aux grandes déformations : quelques résultats 1d*. Proceedings of the 6th national meeting DYMAT, CEG, Gramat, 1990.

**3.** G. Allaire, E. Bonnetier, G. Francfort et F. Jouve, *A topological approach to shape optimization*. ICIAM 95 special issue of ZAMM, Applied Stochastics and Optimization, O. Mahrenholtz et al. eds., Springer, pp. 255–258, 1996).

**4.** E. Bonnetier, R.S. Falk et M. Grinfeld. *A one-dimensional model to account for stress driven rearrangement in the equilibrium shape of a deformable crystal*. Proceedings of the Conference on Inverse problems, Control and Shape Optimization (PICOF'98), Carthage, Tunisia, 98.

**5.** E. Bonnetier et F. Jouve. *Checkerboard instabilities in shape optimization by homogenization*. Proceedings of the Conference on Inverse problems, Control and Shape Optimization (PICOF'98), Carthage, Tunisia, 98.

**6.** E. Bonnetier, M. Brassel, A. Chambolle et F. Jouve, *A variational approach to stress-induced instabilities in heteroepitaxial growth*, XIth International Conference on Fracture, Turin, March 2005.

**7.** E. Bonnetier et F. Ben Hassen, *Asymptotics of the potential in a perturbed periodic composite medium containing misplaced inclusions*, Oberwolfach Report **49/2005**, 2776–2778, 2005.

**8.** E. Bonnetier and S.G. Sista, *Asymptotics for the potential in a periodic network with localized defects*, PAMM. Proc. Appl. Math. Mech. 7, 1050601-1050602 (2007) / DOI 10.1002/pamm.200700174

## PATENT

H. Ammari, E. Bonnetier, Y. Capdeboscq, M. Fink, M. Tanter, *Procédé et dispositif de la tomographie d'impédance électrique par perturbation élastique*, (N° FR 0608538 dépôt 28/09/2006 extension PCT/FR2007/052021).

## TECHNICAL REPORTS

**1.** Un solveur de Riemann pour un système hyperélastique-plastique 1-d en grandes déformations, *Rapport du CEA DAM*, 1989.

**2.** An algorithm for non local strain softening, *Rapport interne du CMAP, Ecole Polytechnique # 241*, 1991.

**3.** Un solveur de Riemann adapté à certains systèmes hyperboliques, *Rapport du CEA DAM 2700*, 1992 (avec B. Mourrain).

**4.** Etude d'algorithmes 1d de suivi de front, *Rapport SNPE, Contrat # 2092*, 1994.

## **INVITED TALKS and SEMINARS**

- SIAM Annual Meeting, Chicago, 1990.
- Université P. Sabatier, Toulouse, Mars 1991.
- Ecole Nationale des Ingenieurs de Tunis, Avril 1991.
- IMA Lisbonne, Mai 1991.
- Universidad de Chili, Santiago, Jan. 1993.
- Université J. Fourier, Grenoble, Avr. 1993.
- Ecole Nationale des Ingenieurs de Tunis, Mai 1993.
- Universidad de Chile, Santiago, Juin 1995.
- Rutgers University, Fév. 1996.
- University of Utah, Salt Lake City, Mai 1996.
- University of Maryland, Baltimore County, Oct. 1996.
- University of Maryland College Park, Nov. 1996.
- Picof'98 Carthage, Tunisia, Avr. 1998.
- Ecole Polytechnique de Tunisie, Oct. 1998.
- University of Texas, Austin, Oct. 98.
- University of Florida, Gainesville, Nov. 98.
- Université d'Orleans, Nov. 98.
- Université de Lyon 1, Fév. 99.
- Universidad de Concepcion, Chile, Mars 99.
- Universidad de Chile, Santiago, Mars 99.
- ICIAM, Edimbourg, Juil. 1999.
- Ecole Polytechnique de Tunisie, Oct. 1999.
- University of Florida, Gainesville, Nov. 99.
- ETH Zürich, Déc. 99.
- MSRI, Berkeley, Mars 2000.
- Université J. Fourier, Grenoble, Oct. 2000.
- E.P.F. Lausanne, Oct. 2000.
- Danish Technical University, Nov. 2000.
- Ecole normale supérieure, Déc. 2000.
- Université de Saint-Etienne, Novembre 2001.
- 6ème Congrès Franco-Chilien de Mathématiques Appliquées, Santiago, Déc. 2001.
- Université Paris 6, Janvier 2002.
- Picof 02, Carthage, Tunisie, Avril 2002.
- AMS-IMS-SIAM Summer Research Conference on "Waves in Periodic and Random Media", Mount Holyoke, Juillet 2002.
- Rencontres Optimisation de Formes, CIRM Luminy, Juil. 2003.
- Computational methods in multiscale analysis and applications, U. of Florida, Gainesville, Fév. 2004.
- Université Rennes 1, Avril 2004.
- Ecole Polytechnique (groupe de travail 'Ondes'), Janvier 2005.
- Université de St. Etienne, Fév. 2005.
- XIth International Congress on Fracture, Turin, Mars 2005.

- Inverse Problems-Multiscale Analysis and Homogenization, Seoul, Juin 2005.
- 8th U.S. National Congress on Computational Mechanics, (symposium Mathematics of Homogenization) July 24–28th, 2005.
- Rencontre internationale ‘Optimisation de Formes et applications’, Nancy, 20–22 oct. 2005.
- Oberwolfach workshop ‘Reactive Flow and Transport Through Complex Systems’, Novembre 2005.
- Special session ‘Imaging, homogenization, and shape optimization – a confluence of ideas’ Spring Southeastern Meeting of the AMS, Miami, Avril 2006.
- Journées EDP de Metz, Aspects géométriques des EDP et Applications, Avril 2006.
- Special session on Shapes and Free Boundaries, AIMS’ 6th International Conference on Dynamical Systems, Differential Equations and Applications, Poitiers, 25–28 Juin 2006.
- International workshop ‘Challenges and Opportunities in Nano-Optics’, Shanghai, China, 5-9 Janvier, 2007.
- Université du Chili, Santiago, Janvier 2007.
- Cinquièmes Journées Singulières, CIRM, Luminy, 23-27 avril, 2007.
- Université de Clermont Ferrand, mars 2007.
- Journées CPER Nancy-Metz, Nancy, décembre 2007
- International Conference on Partial Differential Equations and Applications, Beijing Normal University, Mai 2007.
- ICIAM 2007, mini-symposium “Microstructures and PDE”, Zurich, 16–20 juillet 2007.
- Université du Chili, Santiago, jan. 2008.
- 4th International Conference on Inverse Problems, Control and Shape Optimization, PICO’08. Marrakech, Maroc, avril 2008.
- Conference on Imaging Microstructures: Mathematical and Computational Challenges. IHP, Paris, France, juin 2008.
- Université de Florence, nov. 2008.
- Inverse Problems: Inverse problems; recent progress and new challenges. Banff International Research Station for Mathematical Innovation and Discovery, nov. 2008.
- Colloque Modélisation mathématique en mécanique, Congrès Français de Mécanique, Marseille, Aug. 2009.
- Asymptotic methods in mechanics and other applications, Rennes KerLann, Aug. 2009.
- International Conference on Elliptic and Parabolic Equations, Berlin Weierstrass Institute, Nov. 09.
- Workshop on Control and Inverse Problems, IISc Bangalore, Dec. 2009.
- WIPA 2010, Workshop on Inverse Problems and Applications, Valparaiso, 2009.

-Some mathematical problems of material science: effects of multiple scales and extreme aspect ratios Banff International Research Station for Mathematical Innovation and Discovery, Feb. 2010.

### **PHD STUDENTS and POSTDOCS**

- Faten Khayat (PhD 1997–2001 co–direction with T. Hadhri, Ecole Polytechnique de Tunisie) currently, assistante de mathématiques, Faculté de Bizerte).
- Fehmi Ben Hassen (PhD 1999–2004, co–direction with A. Ben Abda, ENIT Tunis) then postdoc at the University of Göttingen, and now assistant professor position at the University of Tunis.
- Morgan Brassel ( PhD 2003–2008, currently preparing the French agrégation de mathématiques).
- Elie Bretin, (PhD 2005–2009, co–direction with V. Perrier, LJK) currently postdoc at Ecole Polytechnique,
- Frédéric Huguet, (PhD 2005, co–direction with F. Devernay) currently research engineer CEA Grenoble.
- Mouhcine Tilioua, postdoc CNRS (2004–2005).
- Sivaji Ganesh Sista, postdoc Région Rhône–Alpes, (2004–2005) currently assistant professor, Indian Institute of Technology, Bombay.
- J.F. Babdjian, postdoc CNRS (2007–2008) currently maître de conférences, Université de Paris 6.
- David Manceau, ATER (2008–2009) currently maître de conférences, Université du Havre.
- H. Amrani Souhli, postdoc ANR (since april 2009).