

# Curriculum Vitae

Antoine HENROT  
Ecole des Mines and Institut Elie Cartan  
Nancy

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## 1 Personal data

- born August 13th, 1957 in Metz (France), french, married, 5 children (24-22-22-20-13 years old)
- DEA d'analyse (master's degree) in University of Nancy in 1980. I also passed during the same year the *agrégation de mathématiques* (national concourse to become professor in high school), where I was ranked 47th in France.
- Thèse de troisième cycle (PhD) in algebraic topology in Nancy in 1982. Supervisor: Claude Morlet. The title of the PhD: *la K-Théorie d'une algèbre de Banach*.
- Assistant Professor, then Maître de Conférences (associate professor) in the University of Nancy I from 1984 to 1992.
- Habilitation à diriger des recherches, title: *Quelques problèmes mathématiques en formage des métaux liquides* (some mathematical problems in the shaping of liquid metals) in 1992 in Nancy.
- Full Professor at the University of Besançon, France from 1992 to 1998.
- Full Professor at Ecole des Mines and Institut Elie Cartan, Nancy France (since September 1998).

## 2 Fields of research

Partial differential equations, nonlinear analysis and numerical analysis, especially

- free boundaries and over-determined partial differential equations
- shape optimization (optimum design)
- eigenvalue problems
- symmetry and convexity results in partial differential equations
- calculus of variations
- numerical simulation

**Publications:** I have written 2 books, 46 papers in International Journals with referees, 7 papers in Proceedings (see the enclosed list).

**Conferences:** I have given 41 invited conferences in International conferences, 47 invited talks in local seminars or national workshops (see below).

### 3 Responsibilities

#### 3.1 Administrative responsibilities

I am currently (since January 2005 and till December 2008) Head of Institut Elie Cartan. This Institute, supported by CNRS-INRIA-University of Nancy, brings together all the researchers in mathematics in Nancy. It counts 89 permanent people: 33 full professors, 43 assistant professors, 7 researchers and 6 administrative staff as well as 37 PhD students and post-docs.

My other recent or current responsibilities:

- Head of the Department "Industrial Engineering" in Ecole des Mines de Nancy since January 2002.
- Expert for mathematics for the French Ministry and the Italian Ministry of Education and Research.
- administration of two industrial contracts (30 000 euros each) with EADS and IFP linked with the PhD thesis of S. Duprey and S. Baillet (see below).
- Reviewer for many papers (at least 4-6 reviews per year).

#### 3.2 Supervision of PhD thesis

I have supervised the PhD thesis of the following students, the two given dates are the beginning and the end of the thesis.

1. Diaraf SECK (1992-1996, currently associate professor at Dakar University - Senegal) Free Boundary Problem in electromagnetic casting.
2. Thierry CHATELAIN (1994-1997, currently professor in "classes préparatoires" in Montpellier - France) Spectral theory and Pompeiu's problem.
3. Mohamed BARKATOU (1993-1997, currently associate professor at El Jadida University - Morocco) A shape optimization problem with a geometric constraint.
4. Hervé MAILLOT (1994-1998, currently Maître de Conférences (associate professor) at Orléans University - France) Optimal shape and location for actuators.
5. Grégory VILLEMIN (1994-1998, currently research engineer at Valeo - Paris) Optimal shape of a magnet in an industrial problem.

6. Pascal HEBRARD (1999-2002, currently research engineer at Dassault Systems - Paris) Theoretical and numerical study of the location of the control in stabilization systems.
7. Edouard OUDET (1999-2002, currently Maître de Conférences (associate professor) at Chambéry University - France) Minimization of the second eigenvalue of the Laplacian.
8. Stefan DUPREY (2002-2006, currently research engineer at Protectic - Paris) Problems of aero-acoustic for Airbus and EADS. Co-supervision with Isabelle Terrasse, François Dubois and Karim Ramdani.
9. Séverine BAILLET (2004-2007 she has just defended last month and is looking for a job as research engineer) Shape optimization of a pump for petrol. Industrial problem for IFP (French Institute of Petrol).
10. Yannick PRIVAT (from september 2005) Inverse modeling in bio-sciences.

## 4 Internationals collaborations

In Germany:

Friedemann Brock (Cologne, then Santiago du Chili), Alfred Wagner (Aachen), Wolfgang Reichel (Karlsruhe), Bernd Kawohl (Cologne).

In Canada:

Gérard Philippin (Québec).

In United States:

Steve Cox (Rice University, Houston), Mark Ashbaugh (Univ. of Missouri, Columbia), Evans Harrell (Georgia Tech, Atlanta).

In Italy:

Giuseppe Buttazzo (Pisa), Antonio Greco (Cagliari).

In Portugal:

Pedro Freitas (Lisbon).

In Sweden:

Henrik Shahgholian (Royal Institute of Technology, Stockholm).

## 5 Publications

### 5.1 Books

- "Variation et Optimisation de formes", with Michel Pierre in the collection "Mathématiques et Applications", vol. **48** Springer, 333 pp, 2005.
- "Extremum problems for eigenvalues of elliptic operators", *Frontiers in Mathematics*, Birkhäuser Verlag, Basel, 202 pp., 2006.

## 5.2 Publications in International Journals

1. "Un problème inverse en formage des métaux liquides", with Michel Pierre, in *Modél. Math. et Anal. Num. (M<sup>2</sup>AN)*, vol.23, n. 1, 1989, p. 155-177.
2. "About existence of equilibria in electromagnetic casting", with Michel Pierre, in *Quarterly of Applied Math.*, vol. 49. n. 3, 1991, p. 563-575.
3. "A nonlinear boundary value problem solved by spectral methods", with Olivier Coulaud, in *Applicable Analysis*, vol. 43, 1992, p. 229-244.
4. "Behaviour of the free boundary in electromagnetic shaping when the surface tension vanishes", in *Nonlinear Analysis T.M.A.*, vol. 20, n. 8, 1993, p. 965-978.
5. "Numerical approximation of a free boundary problem arising in electromagnetic shaping", with Olivier Coulaud, in *SIAM J. of Numerical Analysis*, vol. 31, n. 4, 1994, p. 1109-1127.
6. "Subsolutions and supersolutions in a free boundary problem", in *Arkiv för Matematik*, vol. 32, 1994, p. 79-98.
7. "Continuity with respect to the domain for the laplacian: a survey", in *Control and Cybernetics*, vol. 23, n. 3, 1994, p. 427-443.
8. "Domain optimization problem for stationary heat equation", with W. Horn and Jan Sokolowski, in *Appl. Math. and Comp. Sci.*, vol.6, No.2, 1996, p. 1-21.
9. "How to prove symmetry in shape optimization problems?", in *Control and Cybernetics*, vol. 25, n.5, 1996, p. 1001-1013.
10. "Convexity of free boundaries with Bernoulli type boundary condition", with Henrik Shahgholian, in *Nonlinear Analysis T.M.A.*, vol. 28, n. 5, 1997, p. 815-823.
11. "On a class of overdetermined eigenvalue problems", with Gérard A. Philippin, in *Mathematical Methods in the Applied Sciences*, vol. 20, 1997, p. 905-914.
12. "Un résultat d'existence en optimisation de forme en utilisant une propriété géométrique de la normale", with Mohamed Barkatou, in *ESAIM COCV*, vol. 2, 1997, p. 105-123.
13. "Use of domain derivative to prove symmetry results in partial differential equations", with Mourad Choulli, in *Mathematische Nachrichten*, vol. 192, 1998, p. 91-104.
14. "Some overdetermined boundary value problems with elliptical free boundaries", with Gérard A. Philippin, in *SIAM Journal of Mathematical Analysis*, vol. 29, n.2, 1998, p. 309-320.
15. "Existence results for some optimal partition problems", with Dorin Bucur and Giuseppe Buttazzo, in *Advances in Mathematical Sciences and Applications*, vol. 8, n 2, 1998, p. 571-579.
16. "Overdetermined problems on ring shaped domains", with G.A. Philippin and H. Prébet, in *Advances in Mathematical Sciences and Applications*, vol. 9, n 2, 1999 p. 737-747.

17. "Domain derivative of the leading eigenvalue of a model transport operator", with Mourad Choulli and Mustapha Mokhtar-Kharroubi, in *Transport theory and statistical physics*, vol. 28 4 (1999), 403-418.
18. "Some results about Schiffer's conjectures", with Thierry Chatelain, in *Inverse Problems*, vol. 15 (1999), p. 647-658.
19. "Continuous Steiner Symmetrization and stability for the Dirichlet problem", with Dorin Bucur, in *Potential Analysis*, vol. 13 (2000), p. 127-145.
20. "Existence of a classical solution to a free boundary problem for the  $p$ -Laplace operator: (II) the interior convex case", with Henrik Shahgholian, *Indiana Univ. Math. Journal*, 49 (2000), no. 1, 311-323.
21. "Existence of a classical solution to a free boundary problem for the  $p$ -Laplace operator I: the exterior convex case", with Henrik Shahgholian, in *Journal für die Reine und Angewandte Mathematik*, **Band 521** (2000), 85-97.
22. "Minimization of the third eigenvalue of the Dirichlet Laplacian", with Dorin Bucur, in *Proceedings of the Royal Society of London*, **456** (2000), 985-996.
23. "Optimal location of the actuator for the pointwise stabilization of a string", with Kais Ammari and Marius Tucsnak, in *C. R. Acad. Sci. Paris Sér. I Math*, **330** (2000), no. 4, 275-280.
24. "Optimization of the shape and the location of the actuators in an internal control problem", with Hervé Maillot, in *Bollettino della Unione Matematica Italiana*, (8) **4-B** (2001), 737-757.
25. "Continuity of the elasticity system solutions with respect to the geometrical domain variations", with Dorin Bucur, Jan Sokolowski, A. Zochowski, in *Advances in Mathematical Sciences and Applications*, **11** (2001), no. 1, 57-73.
26. "On the Bernoulli Free Boundary Problem and related Shape Optimization Problems", with Mohammed Hayouni and Nadia Samouh, in *Interfaces and free Boundaries*, vol 3 (2001), 1-13.
27. "Le stade ne minimise pas  $\lambda_2$  parmi les ouverts convexes du plan", with Edouard Oudet, in *C. R. Acad. Sci. Paris Sér. I Math*, **332** (2001), no. 4, 275-280.
28. "On some recent advances in shape optimization", with Grégoire Allaire, in *C. R. Acad. Sci. Paris Sér. I Ib Mécanique (le point sur /Concise review paper)*, **329** (2001), 383-396.
29. "Optimal pointwise stabilization of a string", en collaboration with Kais Ammari and Marius Tucsnak, in *Asymptotic analysis*, vol. 28, (2001), 215-240.
30. "A symmetry result for an overdetermined elliptic problem using continuous rearrangement and domain derivative", with Friedemann Brock, in *Rendiconti del Circolo Matematico di Palermo, Serie II, Vol. 51* (2002), 375-390.

31. "The one-phase free boundary problem for the  $p$ -Laplacian with non-constant Bernoulli boundary condition", with Henrik Shahgholian, in *Transactions of the AMS*, vol. **354**, no. 6 (2002), 2399-2416.
32. "An Optimum Design Problem in Magnetostatics", with Grégory Villemin, in *Mathematical Modelling and Numerical Analysis (M<sup>2</sup>AN)*, vol. **36**, no. 2 (2002), 223-239.
33. "On numerical solution of shape inverse problems", with L. Jackowska-Strumillo, J. Sokolowski and A. Zochowski, in *Computational Optimization and Applications*, **23** (2002), 231-255.
34. "Optimal shape and position of the actuators for the stabilization of a string", with Pascal Hebrard, in *Systems and Control Letters*, **48** (2003), 199-209.
35. "Minimization problems for eigenvalues of the Laplacian", in *Journal of Evolution Equations*, **3** (2003), 443-461.
36. "Minimizing the second eigenvalue of the Laplace operator with Dirichlet boundary conditions", with Edouard Oudet, in *Archive for Rational Mechanics and Analysis*, **169** (2003), 73-87.
37. "Approximate radial symmetry for solutions of a class of boundary value problems in ring-shaped domains", with Gérard A. Philippin, in *ZAMP*, **54** (2003), 784-796.
38. "Finite Dimensional Reduction for the Positivity of some Second Shape Derivatives", with Michel Pierre and Mounir Rihani, in *Methods and Applications of Analysis*, **10**, no 3 (2003), 457-476 .
39. "The multi-layer free boundary problem for the  $p$ -Laplacian in convex domains", with Andrew Acker, Mikayel Poghosyan and Henrik Shahgholian, in *Interfaces and free Boundaries*, **6** (2004), 81-103.
40. "Positivity of the shape Hessian and instability of some equilibrium shapes", with Michel Pierre and Mounir Rihani, in *Mediterranean Journal of Mathematics*, **1** (2004), 195-214.
41. "On the first twisted Dirichlet eigenvalue", with Pedro Freitas, in *Communications in Analysis and Geometry*, **12**, no 5 (2004), 1083-1103.
42. "A spillover phenomenon in the optimal location of actuators", with Pascal Hébrard, in *SIAM J. Control and Optimization*, **44** no 1 (2005), 349-366.
43. "Mathematical challenges in shape optimization", with Jan Sokolowski, in *Control and Cybernetics*, **34** no 1 (2005), 37-57.
44. "Convergence results for a semilinear problem and for a Stokes problem in a periodic geometry", with Séverine Baillet and Takéo Takahashi, in *Asymptotic Analysis*, **50** 3-4 (2006), 325-337.
45. "Eliciting harmonics on strings", with S. Cox, to appear in *ESAIM COCV*.
46. "Shape minimization of dendritic attenuation", with Y. Privat, to appear in *Applied Mathematics and Optimization* .

### 5.3 Publications in Proceedings

1. "About existence of a free boundary in electromagnetic shaping", with Michel Pierre, in *Recent advances in nonlinear elliptic and parabolic problems*, Pitman Research Notes in Mathematics Series, vol. 208, 1989, p. 283-293.
2. "About critical points of the energy in an electromagnetic shaping problem", with Michel Pierre, in *Lecture Notes and Information Sciences*, 178, J.P. Zolesio ed., Boundary Control and Boundary Variations, Proc. of IFIP Conference, Sophia Antipolis, 1991, p. 238-252.
3. "Some new ideas for a Schiffer's conjecture", with Thierry Chatelain and Mourad Choulli, in *Modelling and Optimization of Distributed Parameter Systems*, K. Malanowski, Z. Nahorski, M. Peszinska eds, Chapman and Hall, 1996.
4. "Retour à une ancienne approche pour un problème à frontière libre classique", with Diaraf Seck, in *Publications Mathématiques de Besançon - Analyse non linéaire*, vol. 15, 1997, p. 29-40.
5. "A Shape Optimization Problem for the Heat Equation", with Jan Sokolowski, in *Optimal Control: Theory, Algorithms and Applications*, Kluwer, W.W. Hager and P.M. Pardalos ed., 1998, p. 204-223. Kluwer.
6. "Comment prouver le caractère étoilé de la solution d'un problème à frontière libre?", in a special issue of "Cahiers Stéphanois de Mathématiques Appliquées ", vol.2, april 2001.
7. "Shape Optimization of a Submerged Pump for Oil", with Séverine Baillet and Jean Brac, Proceedings of the 7th World Congress on Structural and Multidisciplinary Optimization, june 2007.

## 6 Invited Conferences

### 6.1 International Colloquiums and Workshops

1. *Lausanne (Switzerland)*: Fifth International Symposium on Numerical Methods in Engineering (mini-symposium), september 1989.
2. *Günzburg/Donau (Germany)*: Workshop on Boundary Element Methods, october 1991.
3. *Varsovie (Poland)*: Mini-Semester on Parametric and Shape Optimization, april 1993.
4. *Metz (France)*: ESF Workshop on Shape computation: theory and application, november 1993.
5. *Essen (Germany)*: Freie Randwertprobleme und asymptotik von evolutionsgleichungen, april 1994.
6. *Lausanne (Switzerland)*: Conference for the 60th birthday of Jean Descloux, october 1994.

7. *Mulhouse (France)*: Workshop EUCOR on Partial Differential Equations, april 1995.
8. *Seillac (France)*: Spring school, Conformal Geometry, Analysis and Applications, may 1995.
9. *Zakopane (Poland)*: Free Boundary Problems, Theory and Applications, june 1995.
10. *Varsovie (Poland)*: Summer school of the GDR Shape Optimization, july 1995.
11. *Varsovie (Poland)*: IFIP Conference on Modelling and Optimization of Distributed Parameter Systems, july 1995.
12. *Pisa (Italie)*: Workshop ESF on "Variational problems with Free Interfaces", february 1997.
13. *Edinburgh (Ecosse)*: Fourth International Congress on Industrial and Applied Mathematics (2 mini-symposia), july 1999.
14. *Mulhouse (France)*: Workshop EUCOR on Qualitative aspects of Partial Differential Equations, october 1999.
15. *Saint-Etienne(France)* : Workshop on Free Boundary Problems, september 2000.
16. *Paris (France)*: Variational Problems with global constraints, april 2001.
17. *San Diego (USA)*: Fifth SIAM Conference on Control and Applications (mini-symposium), july 2001.
18. *Berlin (Germany)*: 3rd International ISAAC Congress, august 2001.
19. *Poznan (Poland)*: Conference on Mathematical and Engineering aspects of Optimal Design of Materials and Structures, august 2001.
20. *Gaeta (Italy)*: Fourth European Conference on Elliptic and Parabolic Problems, september 2001.
21. *Sarrebruck (Germany)*: Interregional Colloquium of Mathematics, october 2001.
22. *Chambéry (France)*: Calculus of variations, *Journées savoisiennes de mathématiques appliquées*, june 2003.
23. *Lisbonne (Portugal)*: Mathematical Problems in Quantum Mechanics, july 2003.
24. *Pisa (Italie)*: Homogenization and Optimal Design, october 2003.
25. *Metz (France)*: Metz days on Free Boundary Problems, april 2004.
26. *Obernai (France)*: 36<sup>th</sup> National Congress of Numerical Analysis, june 2004.
27. *Copenhagen (Denmark)*: 3rd Colloquium on Applied Analysis, august 2004.
28. *Cagliari (Italy)*: Conference on Elliptic and Parabolic Problems dedicated to Prof. G. Philippin for his 60th birthday, september 2004.

29. *Oberwolfach (Germany)*: Oberwolfach Seminars on Shape Optimization, november 2004.
30. *Metz (France)*: Metz days on eigenvalue problems, april 2005.
31. *Matrei (Austria)*: Geometrical aspects of spectral theory, july 2005.
32. *Vienna (Austria)*: Symmetry problems for nonlinear partial differential equations, january 2006.
33. *Nice (France)* : 3rd PICO (Problèmes inverses, Contrôle et Optimisation de Forme), april 2006.
34. *Palo Alto (USA)*: Workshop on Low Eigenvalues of Laplace and Schrödinger Operators, may 2006.
35. *Poitiers (France)*: Sixth International Conference on Dynamical Systems, Differential Equations and Application (mini-symposium), june 2006.
36. *Paris (France)*: Workshop dedicated to the memory of Thomas Lachand-Robert, january 2007.
37. *Neuchatel (Switzerland)*: Week of Spectral Theory and Geometry, february 2007.
38. *Oberwolfach (Germany)*: Mini-workshop "Shape analysis for eigenvalues", april 2007.
39. *Banff (Canada)*: Workshop "Geometric Inequalities", june 2007.
40. *Cracovie (Pologne)*: 23rd IFIP TC 7 Conference on System Modeling and Optimization (mini-symposium), july 2007.
41. *Stockholm (Sweden)*: Conference on Potential Analysis and Applications dedicated to Prof. Björn Gustafsson for his 60th birthday, october 2007.

## 6.2 Seminars and National Congresses

*INRIA- Rocquencourt (France)*: Seminar of partial differential equations, april 1992. *Les Houches (France)*: Meeting of GDR Optimisation de Forme, march 1993. *Stockholm (Sweden)*: Seminar of analysis of Stockholm University, april 1994. *Linköping (Sweden)*: Seminar of analysis of Linköping University, april 1994. *Lausanne (Switzerland)*: Meeting of GDR Shape Optimization and Equations Coupling, december 1994. *Rennes (France)*: Seminar of numerical analysis of Rennes University, december 1994. *Grenoble (France)*: Seminar of partial differential equations of IMAG, Grenoble University, march 1995. *Leipzig (Germany)*: Seminar of analysis of Leipzig University, april 1995. *Strasbourg (France)* : Seminar of analysis of Strasbourg University, november 1995. *Köln (Germany)*: Seminar of analysis of Köln University, january 1996. *Québec (Canada)*: Seminars of analysis and of numerical analysis of Laval ,University february and march 1996. *Providence (U.S.A.)*: Seminar of analysis of Brown University, july 1996. *Nancy (France)* : Seminar of partial differential equations of Nancy University, october 1996. *Orléans (France)*: Seminar of analysis of Orléans University, november 1996. *Paris (France)*: Seminar of non linear analysis of Ecole Normale Supérieure de la rue d'Ulm, january 1997. *Firenze*

(*Italy*): Seminar of analysis of Firenze University, february 1997. *Stockholm (Sweden)*: Seminar of analysis of Stockholm University and of Royal Institute of Technology, april 1997. *Stockholm (Sweden)*: Seminar of Potential Theory of Royal Institute of Technology, april 1997. *Rabat (Maroc)*: Seminar of analysis of Rabat and Kenitra Universities and of Ecole Mohammedia, november 1997. *Mulhouse (France)*: Seminar EUCOR of Universities of Basel, Freiburg, Karlsruhe and Mulhouse, january 1998. *Nancy (France)*: Seminar of partial differential equations of Nancy University, march 1998. *Nice (France)*: Seminar of analysis of Nice University, october 1998. *Rennes (France)*: Seminar of analysis of Rennes University, november 1998. *Metz (France)* : Metz days on Shape Optimization, march 1999. *Metz (France)*: Meeting on Control in Grand-Est, october 1999. *Lyon (France)*: Colloquium of Ecoles Centrales, december 1999. *Québec (Canada)*: Seminar of analysis of Laval University, december 1999. *Cachan (France)*: Seminar of analysis of ENS Cachan, may 2000. *Nancy (France)*: Journées de l'Institut Elie Cartan, june 2001. *Strasbourg (France)* : Seminar of analysis of Strasbourg University, january 2002. *Paris (France)*: Seminar of calculus of variations of Paris-Dauphine University, february 2002. *Chambéry (France)*: Colloquium of the Mathematic Department, april 2002. *Québec (Canada)*: Seminar of analysis of Laval University, june 2002. *Ulm (Germany)*: Colloquium of the Mathematic Department, july 2002. *Tunis (Tunisia)*: Seminar of analysis of Tunis University and ENIT, november 2002. *Metz (France)*: Seminar of analysis of Metz University, november 2002. *Nice (France)*: Seminar of analysis of Nice University, november 2002. *Aachen (Germany)*: Seminar of analysis of Aachen University, february 2003. *Grenoble (France)*: Seminar of partial differential equations of IMAG- Grenoble University, april 2004. *Amiens (France)*: Seminar of analysis of Amiens University, june 2004. *Metz (France)*: Seminar of analysis of Metz University, october 2004. *Strasbourg (France)*: Seminar of analysis of Strasbourg University, june 2005. *Grenoble (France)*: Colloquium of Institut Joseph Fourier, march 2006. *Cologne (Germany)*: Lectures on shape optimization, december 2006. *Toulouse (France)*: Seminar of partial differential equations of MIP (Toulouse University), april 2007. *Zürich (Suisse)*: Seminar of analysis of Zürich University, may 2007. *Sophia-Antipolis (France)* : Special Day on Shape Optimization in INRIA, september 2007.

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