TITLES AND WORKS

Anna Rozanova-Pierrat

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Date of birth: 20 December 1980
Place of birth: Moscow
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Chapter 1

Curriculum Vitæ

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1.1 Current Situation

From 01/09/2010 **Associate Professor** (Maître de Conférences) Laboratoire de Mathématiques et Informatique pour la Complexité et les Systèmes, Fédération de Mathématiques, CentraleSupélec, Université Paris-Saclay

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1.2 Other Professional Experience

01/09/2009-31/08/2010 **Temporary Teaching and Research Assistant** in Laboratoire Analyse, Géométrie et Applications, Département de Mathématiques, Institut Galilée, Université Paris 13

01/07/2007-30/08/2009 **Post-doc CNRS** in Laboratoire de Physique de la Matière Condensée (PMC) of École Polytechnique

Subject Waves propagation towards irregular interfaces

Responsible person Bernard Sapoval and Marcel Filoche

2006/2007 **Post-doc** at Centre des Mathématiques Appliquées (CMAP) of École Polytechnique

Subject Medical Imaging, inverse problem for the Helmholtz equation

Responsible person Habib Ammari

1.3 Diplomas in Mathematical Sciences

2020 **HDR** in Applied Mathematics of Université Paris Saclay

Obtained 2 November 2020

Title "Wave propagation and fractal boundary problems: mathematical analysis and applications"

Jury
- ALLAIRE Grégoire, Professeur, CMAP, École Polytechnique, président
- LAFITTE Olivier, Professeur, LAGA, Institut Galilée, Université Sorbonne Paris Nord (Université Paris 13), examinateur
- LEMARIE-RIEUSSET Pierre Gilles, Professeur, LaMME, Université Paris Saclay, examinateur
- LANCIA Maria Rosaria, Professeur, Dip. S.B.A.I, Sezione di Matematica, Universita' di Roma Sapienza, rapportatrice
- LANNES David, Directeur de recherche au CNRS, Institut de Mathématiques de Bordeaux, Université de Bordeaux, rapporteur
- SAUT Jean-Claude, Professeur émérite, Département Mathématiques, Université Paris 11, Université Paris Saclay, rapporteur interne
- BARDOS Claude, Professeur émérite, LJLL, Université Paris 7 Denis Diderot, Université de Paris, examinateur

2007 **"VAK" Diploma** of PhD in Mathematical Sciences of Russia

2003-2006 **PhD in Applied Mathematics** joint with Peoples' Friendship University of Russia (URAP) in Moscow

Place University Pierre and Marie Curie (Paris 6), Laboratoire Jacques Louis Lions (LJLL)

Title Khokhlov-Zabolotskaya-Kuznetsov Equation. Mathematical analysis, validation of the approximation and control method.

Obtained the 6 July 2006 at Paris 6

Jury Claude Bardos, François Golse, Nikolay Tzvetkov, Edriss Titi, Josselin Garnier, Alain Haraux

Scientific advisers Claude Bardos, M. F.Sukhinin

Reporters Thierry Colin, Nikolay Tzvetkov

Mention With honors (Très honorable)

Finance support Grant of the Russian President

2002-2003 **Master degree of science in mathematics**

Place URAP, Moscow

Mention With honors

1997-2002 **Bachelor of Science in mathematics**

Place URAP, Moscou

Mention With honors

1.4 Diplomas in teaching

2003 **Certificate of a teacher in mathematics** at Higher educational institutions.

Lieu URAP, Moscow

Mention With honors

2002 **Certificate of the title of a teacher in mathematics** at secondary educational institutions (secondary school)

Place URAP, Moscow

1.5 Computer Skills

- Programmation Languages: Matlab, COMSOL, FreeFem++, Fortran, Pascal, APL, Basic, HTML, LaTeX
- Softwares: Office
- O.S.: Windows, Unix, Linux, Mac OS

1.6 Languages

- **French**: bilingual
- **English**: written and oral
- **Russian**: native language

Chapter 2

Teaching activities

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2.1 Associate Professor at CentraleSupélec

2.1.1 Actual teaching

- **In charge of the 3rd year course** "Differential partial differential equations on domains with irregular and fractal boundaries", 27 hours, level M2 (first time in 2020).
- **Co-in charge and responsible for the ST5 module "Wave control : theory and algorithmic"** (Module "Context and Issues", Lectures, Tutorials, TP, a week of the "integration teaching" project of 3 subjects:

  1. Noise pollution control exterior (charged),
  2. Interior Acoustic Pollution Control, (co-lead),
  3. Control of electromagnetic pollution, (co-leader).

  (level M1, handout of the course, 72h with a 9h part of computer science and numerical analysis by F. Magoulès)
- **In charge of tutorials in "CIPEDP"(Convergence, Integration, Probability and Partial Differential Equations course)** (level L3, 33h)
- Superviser of a student - Gabriel Claret - in the science and research orientation (parcours "Recherche") (previously, Mathieu Lestienne, Aleksa Ciric, Mohammed Amine Zouhair, Antoine Verdon, Mariem Mezghanni)

2.1.2 Previous teaching

- **Responsible for Courses " Functional Analysis"** (level M2, 21h) (in English in 2014) `http://cours.etudes.ecp.fr/claroline/course/index.php?cid=MA3100`

- **Responsible for Project Courses "Optimization of silent walls by fractals"** (level M1, 33h)
- **Responsible of the calculus in "PDEs and Numerical Analysis"** (level L3, 27h)
- **Superviser** of a scientific projects (Kevin Arfi, "Laplacian transport towards fractals", level: 3^{th} year)
- **Co-responsible of a MOOC on Coursera "Introduction to Functional Analysis"** (development of a PDF supports for 8 topics 172 pages)

  `https://www.coursera.org/course/functionalanalysis`
- **Innovation** scientific projects (level: 2^{th} year)
- **Responsible for Courses "Modelling methods in the fluid mechanics"** Master "Calcul Haute Performances" MIHP (level M2, 36h)
- **Responsible for Courses "Simulation and optimization"** (level: 1^{th} year, 26h)
- **Responsible of the calculus in "Probability"** (level: 1^{th} year, 11h)
- **Responsible of the calculus in "Analysis"** (level: 1^{th} year, 11h)

Previously I have also teached in the University Paris 13, Paris 10, École Nationale de la Statistique et de l'Administration Économique (ENSAE) and URAP in Moscow.

Chapter 3

Research

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3.1 Research interest

- Theory of inverse problems and control
- EDPs on fractals
- Wave propagation
- Spectral analysis
- Non-linear EDPs

3.2 Supervision

- *Gabriel Claret*, 10/2023-..., Ph.D. director ''Imaging and inverse scattering problems with non-Lipschitz absorbing boundaries", CentraleSupélec, EDMH.
- *Gabriel Claret*, internship of M2 "Probabilistic, functional and spectral analysis in non-Lipschitz domains" (with A. Teplyaev and M. Hinz) 24/04/2023-08/10/2023.
- *Julien Malartre*, internship of M1, "Boundary regularity in imaging problems and inverse problems" 20/06/2022 –15/07/2022.
- *Gabriel Singer*, M1 equivalent internship, "Existence of an optimal form in heat exchanges" (June-August 2021)
- *Marien Chenaud*, M2 equivalent internship, "Inverse problems in the diagnosis of tumor vascularization" (September 2020-January 2021)

- *Adrien Dekkers*, scientific co-adviser of the PhD thesis "Mathematical analysis of the Kuznetsov equation: Cauchy problem, approximation questions and problems with fractal boundaries" 01/10/2015-22/03/2019, CentraleSupélec, EDMH.
- *Vladimir Khodygo*, reserch internshipe "Models of the non-linear acoustic", 6 months, 2014-2015.
- *Alisa Sedunova*, internshipe M2, "Derivation of equations of the non-linear acoustic", 5 months, 2013.
- *Phuong Kieu Nguyen*, internshipe M2 6 months and reserch internshipe of 6 months "Shape optimization of an acoustical barrier", 2011-2012.

3.3 Publications & Communications

3.3.1 Journals with a committee of lecture

1. M. Hinz, A. Rozanova-Pierrat, A. Teplyaev, *Boundary value problems on non-Lipschitz uniform domains: Stability, compactness and the existence of optimal shapes*, Asymptotic Analysis, vol. 134, no. 1-2, pp. 25-61, 2023 DOI: 10.3233/ASY-231825
`https://arxiv.org/abs/2111.01280`
2. A. Dekkers, A. Rozanova-Pierrat, *Dirichlet boundary valued problems for linear and nonlinear wave equations on arbitrary and fractal domains*, Journal of Mathematical Analysis and Applications, 512 (2022) 126089, `https://doi.org/10.1016/j.jmaa.2022.126089`
`https://authors.elsevier.com/a/1ehCC,WNxmxo8`
3. A. Dekkers, A. Rozanova-Pierrat, A. Teplyaev, *Mixed boundary valued problems for linear and nonlinear wave equations in domains with fractal boundaries*, Calculus of Variations and Partial Differential Equations, (2022) 61:75 `https://doi.org/10.1007/s00526-021-02159-3`,
`https://rdcu.be/cIgI4`
4. M. Hinz, A. Rozanova-Pierrat, A. Teplyaev, *Non-Lipschitz uniform domain shape optimization in linear acoustics*. à paraître dans SIAM J. Control Optim. DOI 10.1137/20M1361687
`https://hal.archives-ouvertes.fr/hal-02919526`.
5. M. Hinz, F. Magoulès, A. Rozanova-Pierrat, M. Rynkovskaya, A. Teplyaev, *On the existence of optimal shapes in architecture*. Applied Mathematical Modelling, Vol. 94, (2021), pp. 676–687. DOI 10.1016/j.apm.2021.01.041
`https://authors.elsevier.com/a/1cbQY,703q6p69`
`https://hal.archives-ouvertes.fr/hal-02956458`.
6. F. Magoulès, P.T.K. Ngyuen, P. Omnes, A. Rozanova-Pierrat, *Optimal absorbtion of acoustic waves by a boundary*. SIAM J. Control Optim. Vol. 59, No. 1, (2021), pp. 561-583.
`https://hal.archives-ouvertes.fr/hal-01558043`
7. A. Rozanova-Pierrat, Generalization of Rellich-Kondrachov theorem and trace compacteness for fractal boundaries, *chapitre du livre "Fractals in engineering: Theoretical aspects and Numerical approximations", Volume ICIAM 2019 Proceedings.*
`https://www.springer.com/us/book/9783030618025`
8. A. Dekkers, A. Rozanova-Pierrat, Models of nonlinear acoustics viewed as an approximation of the Navier-Stokes and Euler compressible isentropic systems, *Commun. Math. Sci.* Vol. 18,

No. 8, (2020), pp. 2075–2119.
https://hal.archives-ouvertes.fr/hal-01935515

9. A. Dekkers, V. Khodygo, A. Rozanova-Pierrat, Models of nonlinear acoustics viewed as approximations of the Kuznetsov equation. *DCDS-A*, Vol. 40, No. 7, 2020, (28 pages).
https://hal.archives-ouvertes.fr/hal-02134311

10. K. Arfi, A. Rozanova-Pierrat, Dirichlet-to-Neumann or Poincaré-Steklov operator on fractals described by d-sets. *Discrete & Continuous Dynamical Systems – S*, Vol. 12, No. 1, 2019, pp. 1–26

11. K. Arfi, A. Rozanova-Pierrat, Dirichlet-to-Neumann or Poincaré-Steklov operator on fractals described by d-sets. *Discrete & Continuous Dynamical Systems – S*, Vol. 12, No. 1, 2019, pp. 1–26

12. A. Dekkers, A. Rozanova-Pierrat, Cauchy problem for the Kuznetsov equation. *Discrete & Continuous Dynamical Systems – A*, Vol. 39, No. 1, 2019, pp. 277–307

13. C. Bardos, D. Grebenkov, A. Rozanova-Pierrat, Short-time heat diffusion in compact domains with discontinuous transmission boundary conditions. *Math. Mod. Meth. Appl. Sci.,* Vol. 26, No. 1, 2016, pp. 59–110

14. A. Rozanova-Pierrat, Approximation of a compressible Navier-Stokes system by non-linear acoustical models, *Proceedings of the International Conference DAYS on DIFFRACTION*, 2015 May 25–29, 2015, St. Petersburg, Russia, pp. 270–276

15. A. Rozanova-Pierrat, D. S. Grebenkov, and B. Sapoval, Faster diffusion across an irregular boundary. *Phys. Rev. Lett.*, Vol. 108, 2012, pp. 240602.

16. H. Ammari, Y. Capdeboscq, F. de Gournay, A. Rozanova-Pierrat, and F. Triki, Microwave imaging by elastic perturbation. *SIAM J. Appl. Math.* Vol. 71, 2011, pp. 2112–2130.
http://www.math.ens.fr/~ammari/papers/ACGRPT.pdf

17. A. Rozanova-Pierrat, Perturbative numeric approach in microwave imaging. *Applicable Analysis*, Vol. 89, No. 12, 2010, pp. 1855 – 1877

18. A. Rozanova-Pierrat, On the Controllability for the Khokhlov-Zabolotskaya-Kuznetsov (KZK)-like Equation. *Applicable Analysis*, Vol. 89, No. 3, 2010, pp. 391–408

19. A. Rozanova-Pierrat, On the Derivation and Validation of the Khokhlov-Zabolotskaya-Kuznetsov (KZK) Equation for Viscous and Nonviscous Thermo-ellastic Media. *Commun. Math. Sci.*, Vol. 7., No. 3, 2009, pp. 679–718

20. A. Rozanova-Pierrat, Qualitative Analysis of the Khokhlov-Zabolotskaya-Kuznetsov (KZK) Equation. *Math. Mod. Meth. Appl. Sci.,* Vol. 18, No. 5, 2008, pp. 781–812

21. A. Rozanova, Khokhlov-Zabolotskaya-Kuznetsov Equation. *C. R. Acad. Sci. Paris, Ser. I* Vol. 344, 2007, pp. 337–342

22. A.V. Rozanova, Letter to the Editor. *Mathematical Notes,* Vol. 78, No. 5-6, 2005, p. 745

23. C. Bardos, A. Rozanova, KZK Equation. *Spectral and Evolution Problems* (Proceedings of the Fifteenth Crimean Autumn Mathematical School-Symposium) Vol. 15, 2004, pp. 154–159

24. A.V. Rozanova, Controllability for a Nonlinear Abstract Evolution Equation. *Mathematical Notes,* Vol. 76, No. 4, 2004, pp. 511–524

25. A.V. Rozanova, Controllability in a Nonlinear Parabolic Problem with Integral Overedetermination. *Differential Equations,* Vol. 40, No. 6, 2004, pp. 853–872

3.3.2 Proceedings

- Rozanova A.V. An inverse problem for a quasilinear heart conductivity equation with an integral overdetermination. - *the thesis of the Russian conference XXXVIII on problems of mathematics, of informatics, of physique, of chime and of methods of the teaching of natural sciences,* 14 - 17 May 2002 - Mathematical sections - Moscow 2002, p.22. (in Russian)
- Rozanova A.V. An inverse problem for a nonlinear abstract equation of evolution. - *the thesis of the Russian conference XXXIX on problems of mathematics, of informatics, of physique, of chime and of methods of the teaching of natural sciences,* 21 - 25 April 2003 - Mathematical sections - Moscow 2003, p.13. (in Russian)
- Bardos C., Rozanova A. KZK equation. *"International Conference Crimean Autumn Mathematical School-Symposium (KROMSH-2004) Ukraine, Crimea, Laspi-Batiliman,* September 18-29, 2004. pp.3-10.
- Bardos C., Rozanova A. KZK equation. *International conference and workshop "Function Spaces, Approximation Theory, Nonlinear Analysis" dedicated to the centennial of Sergei Mikhailovich Nikolskii,* Russian Academy of Sciences V. A. Steklov Mathematical Institute, Moscow, Russia, May 23-29, 2005, p.258.
- Bardos C., Rozanova A. Khokhlov-Zabolotskaya-Kuznetsov Equation. *The Fourth International Conference on Differential and Functional Differential Equations,* Moscow, Russia, August 14-21, 2005, p.19.
- A. Rozanova-Pierrat, Reconstruction de la permittivité et de la conductivité dans la tomographie d'impédance électrique par déformation élastique.*International workshop on analysis and control of partial differential equations, dedicated to Jean-Pierre Puel for his 60th birthday,* Pont-à-Mousson, France, 2007.
- B. Sapoval, A. Rozanova-Pierrat, S. Félix, M. Filoche, Irregular sound absorbers work better. *J. Acoust. Soc. Am., Vol. 123, No. 5, Pt. 2,* May 2008 Acoustics'08 Paris, p. 3497.

3.3.3 Preprints

- Rozanova-Pierrat A. Controllability question for Khokhlov-Zabolotskaya-Kuznetsov (KZK) equation. Preprint of Laboratory Jacques-Louis Lions, 26 pages. `http://www.ann.jussieu.fr/public`
- Rozanova A.V. An inverse problem for a nonlinear abstract equation of evolution. *Vestnik Russ. Univ. Dryzhby Narodov, Ser. Math.* (2003), No. 10(1), p. 72-90, (in Russian)
- Rozanova A.V. An inverse problem for a quasilinear heart conductivity equation with an integral overdetermination. *Vestnik Russ. Univ. Dryzhby Narodov, Ser. Math.* (2002), No. 9(1), p. 112-134. (in Russian)

3.3.4 Oral Communications in the International Congress (with a reviewer process)

- A. Rozanova-Pierrat, "Short Time Heat Diffusion in Bounded Domains with Discontinuous Transmission Boundary Conditions", The 11th AIMS International Conference on Dynami-

cal Systems, Differential Equations and Applications, July 1 – July 5, 2016, Orlando, USA. (invited)

- C. Bardos, D. Grebenkov,A. Rozanova-Pierrat,"Heat content asymptotic propagation in compact domains with discontinuous transmission boundary conditions", The 10th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Madrid, Spain (July 2014)
- A. Rozanova-Pierrat, "Mathematic Analysis of the KZK Equation", Waves'09, Pau, France (June 2009)
- B. Sapoval, A. Rozanova-Pierrat, S. Félix, M. Filoche, "Irregular sound absorbers work better". Acoustics'08, Paris, France (June 2008)
- A. Rozanova-Pierrat, "Reconstruction of the Permittivity and Conductivity in Impedance Tomography by Elastic Deformation". International workshop on analysis and control of partial differential equations, dedicated to Jean-Pierre Puel for his 60th birthday, Pont-à-Mousson, France (June 2007)
- A. Rozanova, "Controllability for nonlinear equations of evolution", International Workshop on Inverse Problems, Boundary Control and Integral Geometry, Khanty-Mansiysk, Russia (August 2005), (invited cours of 1h)
- C. Bardos, A. Rozanova, "Khokhlov-Zabolotskaya-Kuznetsov equation", The Fourth International Conference on Differential and Functional Differential Equations, Moscow, Russia (August 2005)
- C. Bardos, A. Rozanova, "KZK equation", International conference and workshop on Function Spaces, Approximation Theory, Nonlinear Analysis dedicated to the centennial of Sergei Mikhailovich Nikolskii, Russian Academy of Sciences V. A. Steklov Mathematical Institute, Moscow, Russia, (May 2005).
- C. Bardos, A. Rozanova, "KZK equation", Crimean Autumn Mathematical School-Symposium, Laspi, Ukraine (Septembre 2004)
- A. Rozanova, "On the controllability for nonlinear abstract equations of evolution", Conférence en l'honneur de 60$^{\text{ème}}$ anniversaire de Haim Brezis, Paris, France (June 2004)

3.3.5 Oral Communications in French and Russian Congress (with a reviewer process)

- A. Rozanova-Pierrat, B. Sapoval, D. Grebenkov, "Diffusion à travers une frontière irrégulière", SMAI 2011, Guidel, France (May 2011)
- A. Rozanova-Pierrat, B. Sapoval, S. Félix, M. Filoche, "Astride localization in irregular sound absorbers", 39$^{\text{ème}}$ Congrès National d'Analyse Numérique, Saint-Jean de Monts, France (Mai 2008)
- A.V. Rozanova, "An inverse problem for a nonlinear abstract equation of evolution", XXXIX$^{\text{th}}$ Russian Conference on " Mathematical, informatic, physical, chimical and teachnig methodological problems in natural sciences", Moscow, Russia (April 2003)
- A.V. Rozanova, "An inverse problem for a quasilinear heart conductivity equation with an integral overdetermination", XXXVIII$^{\text{th}}$ conférence russe sur "Russian Conference on " Mathemat-

ical, informatic, physical, chimical and teachnig methodological problems in natural sciences", Moscow, Russia (May 2002)

3.3.6 Posters in the International Congress (with a reviewer process)

- A. Rozanova-Pierrat, B. Sapoval, M. Filoche, "Increased coupling of Laplacian eigenmodes between two media separated by an irregular interface", International Congress "Laplacian Eigenvalues and Eigenfunctions: Theory, Computation, Application", Institute for Pure and Applied Mathematics (IPAM), Los Angeles, Californie, (February 2009)
  `http://www.ipam.ucla.edu/programs/le2009/postersession.aspx`
- A. Rozanova-Pierrat, S. Félix, M. Filoche, "Astride localization in cavities filled with an irregular absorber", Shcool "Linear and nonlinear acoustic wave propagation in heterogeneous media: modern trends and appications", Les Houches, France (Mars 2008)
- A. Rozanova, "Mathematical proprieties of a model of propagation of sound beams in nonlinear media: KZK equation", Shcool "Imaging, Communication, and Disorder", Cargèse, France (June 2006)
- A. Rozanova, "KZK equation", Colloque "Transfert radiatif et approximation de la diffusion : théorie et applications", Marseille, France (September 2005)
- A. Rozanova, "On the controllability for nonlinear abstract equations of evolution", 4^{th} International European Congress of Mathematics 4ECM, section "Partial Differential Equations", Stockholm, Sweden, (June 2004)
  `http://www.math.kth.se/4ecm/abstracts/9.20.pdf`
- A. Rozanova, "Controllability for nonlinear equations of evolution", International Congress "Imaging of complex media with acoustic and seismic waves III", Cargèse, France (September 2003)

3.3.7 Posters in the Frenche Posters Congress (with a reviewer process)

- C. Bardos,A. Rozanova-Pierrat, " Heat content asymptotic propagation in compact domains with discontinuous transmission boundary conditions", Mathematical Modelling of Complex Systems, École Centrale Paris, Châtenay-Malabry (December 2013)
- A. Rozanova-Pierrat, B. Sapoval, M. Filoche, "Morphologie induit la transparence", Congrès général de la Société Française de Physique, Palaiseau, France (July 2009)

3.3.8 Invited Courses

- GDRE CONEDP (Contrôle des équations aux dérivées partielles), laboratoire de mathématiques (UMR 6620 CNRS/UBP) de l'Université Blaise Pascal Clermont-Ferrand, (June 2011)
- International Workshop on "Inverse Problems, Boundary Control, and Integral Geometry", Khanty-Mansyisk, Russia (August 2005)

3.3.9 Participation to conferences without a communication

- Workshop on Imaging Microstructures: Mathematical and Computational Challenges, Institut Henri Poincaré, Paris, France (juin 2008)

- Workshop “Control of Physical Systems and Partial Differential Equations", Institut Henri Poincaré, Paris, France (juin 2008)
- Franco-Korean Days of Mathematical Analysis and Its Applications, Institut Henri Poincaré, Paris, France (février 2008)
- Minicourse on Mathematics of Emerging Biomedical Imaging II, Institut Henri Poincaré, Paris, France (février 2008)
- Minicourse on Mathematics of Emerging Biomedical Imaging I, Institut Henri Poincaré, Paris, France (mars 2007)
- Conférence “Mathematical Modelling in Biology and Medicine", Évry, France (février 2007)
- Colloque GDR “Analyse des Équations aux Dérivées Partielles", Forges-les-Eaux, France (juin 2005)