

CURRICULUM VITAE

Erwan Faou

PERSONAL DATA

Born : 29.11.1973 in Lille (France)

Citizenship : France.

Married, three children.

Home address : 102, avenue de Cork, 35200, Rennes, France.
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DEGREES

- 2007 Habilitation degree in Mathematics, University of Rennes 1,
*Some geometrical aspects in shell theory and in numerical integration
of hamiltonian systems* (defended 16.10.2007).
Jury : P. Chartier, M. Crouzeix, M. Dauge, Y. Maday, C. Lubich,
A. Iserles, P. Joly, J.-M. Sanz-Serna.
- 2000 PhD in mathematics, University of Rennes 1,
Asymptotic expansions in thin linear elastic shells (defended 01.06.2000).
Jury : G. Caloz, P. Ciarlet, M. Costabel, M. Dauge (advisor), J. Pitkäranta,
E. Sanchez-Palencia, C. Schwab.
- 1997 Agrégation de Mathématiques¹, with rank 10.
- 1996 Master of Science in mathematics, University of Paris 7, with rank 1.

1. High-level national competitive examination for the recruitment of teachers.

EDUCATION

1996-1998 Student at the Ecole Normale Supérieure de Cachan Bretagne.

1991-1996 Undergraduate student at the University of Paris VI.

EMPLOYMENT

2009–present Senior researcher (*directeur de recherche*) at INRIA² Bretagne Atlantique.

2001–2009 Junior researcher (*chargé de recherche*) at INRIA Bretagne Atlantique.

1998–2001 Research assistant at the Mathematics Research Institute, University of Rennes 1 (IRMAR).

VISITING POSITIONS

Spring 2010 Invited professor, FIM, ETH Zürich.

Spring 2004 Post-doctoral fellowship in the University of Tübingen (with C. Lubich).

Spring 2003 Post-doctoral fellowship in the University of Geneva (with E. Hairer).

TEACHING

2010 ETH Nachdiplom lecture : *Geometric integration of Hamiltonian PDEs and applications to computational quantum mechanics.*

2001-present Assistant in the preparation of the *Agrégation de Mathématiques* by the students of the Ecole Normale Supérieure de Cachan Bretagne.

2008-2009 Lecturer in the Ecole Normale Supérieure de Cachan Bretagne.
Course : *Ordinary differential equations.*

2003 Lecturer in M.Sc. level, University of Rennes 1.
Course : *Symplectic integration of integrable hamiltonian systems and long-time behaviour.*

1998-2001 Head assistant in the university of Rennes 1.
Courses : Numerical analysis, Introduction to finite elements methods.

2. French National Institute for Research in Computer Science and Control.

PH.D STUDENT ADVISING

- 2011–present Marie Kopec.
Thesis subject : *Langevin equation in finite and infinite dimension : Mathematical and numerical analysis*. Co-advisor : A. Debussche.
- 2009–present Charles-Edouard Bréhier.
Thesis subject : *Numerical methods for highly oscillatory stochastic partial differential equations*. Co-advisor : A. Debussche.
- 2007–2010 Marie Beaudouin.
Thesis subject : *Studying of eigenvalues of axisymmetric shells*.
Co-advisor : M. Dauge.
- 2005–2008 Guillaume Dujardin.
Thesis subject : *Analysis of Splitting methods for the Schrödinger equation*.
Co-advisor : F. Castella.

PROFESSIONAL RESPONSIBILITIES

- 2011–2016 Principal investigator of the ERC Starting Grant Project GEOPARDI.
- 2009–present Coordinator the INRIA Collaborative Research Initiative *Hybrid*.
<http://www.irisa.fr/ipso/perso/faou/hybrid/hybrid.html>
- 2008–present Leader of the INRIA associated team MIMOL grouping members of :
- The IPSO team (INRIA Rennes, France, head : P. Chartier),
 - The numerical analysis group of the University of Tübingen (Germany, head : C. Lubich)
 - The computer science department of the University of the Basque country, (Spain, San-Sebastian, head : A. Murua).
- 2006–2007 French leader of the Procope project : *Geometric integration and applications to quantum and classical molecular dynamics*, in collaboration with the numerical analysis group of the University of Tübingen (head : C. Lubich).
- 2005–2008 Member of the INRIA evaluation board.
- 2005–2006 Member of the *commission personnel* of the IRISA.
- 2003–2008 Member of the *commission de spécialistes* of the ENS Cachan.
- 2003–2004 Coordinator the INRIA Collaborative Research Initiative *Prestissimo*.
<http://www.irisa.fr/aladin/perso/faou/prestissimo/prestissimo.html>.

CONFERENCE AND WORKSHOP ORGANIZATIONS

- 2011 Workshop : *KAM theory and geometric integrators*, june 5-10, BIRS, Banff, Canada.
Organized with W. Craig and B. Grébert.
- 2011 Workshop : *Advanced Numerical Studies in Nonlinear Partial Differential Equations*
January 18-21, University of Edinburgh, UK.
Organized with S. Kuksin, B. Leimkuhler and C. Sulem.
- 2010 Ecole d'été EDF-DEA-INRIA : *Simulation of hybrid dynamical systems and applications to molecular dynamics*, 27- 30 septembre 2010 - IHP - Paris.
Organized with F. Legoll, T. Lelièvre and G. Stoltz.
- 2007 SciCADE 07, *International Conference on SCientific Computation And Differential Equations*, july 9–13, Saint-Malo.
<http://scicade07.irisa.fr>
- 2004 MSAMA : *Molecular simulation : Algorithmic and Mathematical aspects*.
International conference, december 1–3, Institut Henri Poincaré, Paris.
<http://msama.irisa.fr>
- 2003 Workshop Prestissimo, december 11–12, Institut Henri Poincaré, Paris.
<http://www.irisa.fr/aladin/perso/faou/prestissimo/workshop03.html>
- 2001 Organization of a mini-symposium in ENUMATH (Ischia).
Subject : *Shell modeling : asymptotic and numerical methods*.

PARTICIPATION IN RESEARCH PROJECTS

- 2009-2010 Member of the ANR project³ MEGAS, *Geometric methods and sampling : applications to molecular simulation*. Head : Tony Lelièvre (CERMICS).
- 2009–2010 Member of the INRIA Collaborative Research Initiative *Vitelbio*.
Head : Alain Rapaport (INRA) .
- 2003–2006 Member of the ACI project⁴ “Jeunes chercheuses et jeunes chercheurs” :
High-frequency methods for ordinary and partial differential equations.
Head : F. Castella.
- 2004–2007 Member of the ACI project “Nouvelles interfaces des mathématiques” :
Molecular Simulation. Head : C. Le Bris.
- 2005–2008 Member of the ANR project : *Ingemol*, devoted to geometric integration
and molecular simulation. Head : P. Chartier.

3. granted by the French Research Agency.

4. ACI : Actions Concertées Incitatives, granted by the french research ministry.

MAIN INVITATIONS AND VISITS

- October 2011 : Séminaire du laboratoire Jacques-Louis Lions, University of Paris 6.
- September 2011 : Colloque “Rencontre Mathématiques-Mécanique, hommage à Paul Germain”, Congrès Français de mécanique, Besançon.
- June 2011 : Conference : *Nonlinear Dispersive Partial Differential Equations and Related Topics*, Institut Henri Poincaré, Paris.
- June 2011 : Seminar at Fields Institute, Toronto (Canada)
- March 2011 : Workshop on Geometric Numerical Integration, Oberwolfach (Germany)
- February 2011 : Invitation to the university of Tokyo (Japan).
- February 2011 : Séminaire *systèmes dynamiques*, Univ. Paris 7.
- December 2010 : Séminaire EDP et applications, ENS Lyon & Univ. Lyon 1.
- October 2010 : Workshop on time integration, Innsbruck (Austria).
- September 2010 : Workshop on *Asymptotic Regimes for Schrödinger equations*, CIRM, Marseille.
- September 2010 : Workshop on *splitting methods for differential equations*, Castellon (Spain).
- July 2010 : Seminar at the Basque center for applied mathematics, Bilbao (Spain).
- June 2010 : Invitation to the workshop on *Stochastic Partial Differential Equations : Approximation, Asymptotics and Computation*, Newton Institute, Cambridge (UK).
- May 2010 : Seminaire d’analyse numérique, Université de Genève (Switzerland).
- April 2010 : Journée *Dynamiques des équations Hamiltoniennes*, Nantes (France).
- April 2010 : Seminar in the University of Strasbourg (France).
- March 2010 : Seminar of Numerical analysis, University of Tübingen (Germany).
- March 2010 : Analysis Seminar, University of Zürich (Switzerland).
- March 2010 : Seminar at the CMAP, Ecole Polytechnique (France).
- February 2010 : Seminar in the University of Karlsruhe (Germany)
- October 2009 : Rencontres EDP/Probas, Institut Henri Poincaré, Paris.
- September 2009 : ICNAAM 09 on the occasion of the 60th birthday of Ernst Hairer. Invitation in the mini-symposium “Mathematics and chemistry”.
- July 2009 : CECAM Workshop “Fundamental aspects of deterministic thermostats”, CECAM-HQ-EPFL, Lausanne (Switzerland).
- June 2009 : ICOSAHOM 09, Trondheim (Norway). Invitation in the mini-symposium “Geometric methods for PDEs”.

- May 2009 : SCICADE 09 (Beijing). Invitation to the minisymposium “Dynamics by Geometric Numerical Integration” organized by Z. Shang.
- May 2009 : Invitation in the Institute of Mathematics of the Academy of Mathematics and Systems Science (Chinese Academy of Sciences), Beijing (1 week).
- April 2009 : Invitation in the Seminar for Applied Mathematics, ETH Zürich.
- March 2009 : Invitation in the university of Mexico (UNAM, Cuernavaca) (2 weeks).
- February 2009 : Numerical Analysis Seminar, University of Cambridge (UK).
- January 2009 : *Chemical Dynamics : Challenges and Approaches*, IMA Workshop, Minneapolis (USA).
- November 2008 : Seminar in the University of Pau (France).
- October 2008 : Seminar in the Observatoire de Paris (Astronomy and dynamical systems team).
- October 2008 : Seminar in the University of Lille (France).
- June 2008 : Canada-France congress (Montréal). Invitation to the mini-symposium : *Variational and Numerical Methods in Geometry, Physics and Chemistry*, organized by M.J. Esteban, L. Bronsard and E. Cancès.
- March 2008 : Seminar in the University of Mulhouse (France).
- October 2007 : Seminar in the University of Basel (Switzerland).
- Mai 2007 : Seminar at INRIA Sophia Antipolis. Invitation made by the team TOSCA (specialists in the numerical approximation of SDEs).
- April 2007 : Applying Geometric integrators, ICMS Workshop. Edinburgh, Scotland.
- April 2007 : Seminar at the CERMICS (Ecole Nationale des ponts et Chaussée, Marne la vallée, France).
- January and March 2007 : visits and seminar at the Isaac Newton Institute for mathematical sciences, Cambridge, UK. Programme on *Highly Oscillatory Problems : Computation, Theory and Applications*.
- January 2007 : Seminar in the University of Nantes (France).
- September 2006 : Castellon Conference on Geometric Integration (Spain).
- June 2006 : Journées techniques asymptotiques 2006, ENSTA, Paris.
- March 2006 : Workshop on Geometric Numerical Integration, Oberwolfach.
- 2005–2010 : Regular visits and seminars in the University of Tübingen.
- Mai 2005 : SciCADE 05, Nagoya, Japon, mini-symposium *Molecular Dynamics* organized by R. Skeel.

- December 2002 : Ecole d’hiver GO++, *Numerical methods devoted to HJ/HJB problems*. INRIA Rocquencourt (France). Lecture on numerical perturbation theory for dynamical systems.
- July 2001 : ENUMATH, Ischia (Italy).
- October 2002 : GDR EAPQ (Equations D’amplitudes et Propriétés Qualitatives), Institut Henri Poincaré, Paris.
- November 2000 : One month invitation in the Istituto di Analisi Numerica - CNR, Pavia (Italy).
- June 2000 : CANUM 2000 (Congrès d’Analyse Numérique), Vieux Boucau (France).
- April 2000 : Workshop Elastic shell : Modeling, Analysis and Numerics, organized by Doug N. Arnold. Mathematical Sciences Research Institute (MSRI), Berkeley, USA.
- July 1999 : ICIAM 99, Edinburgh, Scotland.
- 1997, 1998 and 1999 : one-week visits in the University of Stuttgart.

PUBLICATIONS

Book

1. E. Faou, *Geometric numerical integration and Schrödinger equations*. European Math. Soc. To appear.

Journal papers

2. M. Dauge, I. Djurdjevic, E. Faou and A. Roessle, *Eigenmode Asymptotics in Thin Elastic Plates*, J. Math. Pures Appl. **78** (1999) 925-964.
3. E. Faou, *Elasticité linéarisée tridimensionnelle pour une coque mince : Résolution en série formelle en puissances de l'épaisseur*, C. R. Acad. Sci. Paris, Sér. I. **330** (2000) 415-420.
4. G. Andreoiu, M. Dauge and E. Faou, *Développements asymptotiques complets pour des coques faiblement courbées encastrées ou libres*, C. R. Acad. Sci. Paris, Sér. I. **330** (2000) 523-528.
5. G. Andreoiu and E. Faou, *Complete asymptotics for shallow shells*, Asympt. Anal. **25** (2001) 239-270.
6. E. Faou, *Développements asymptotiques dans les coques elliptiques : Modèle de Koiter*, C. R. Acad. Sci. Paris, Sér. I. **333** (2001) 139-143.
7. E. Faou, *Développements asymptotiques dans les coques elliptiques : Equations tridimensionnelles linéarisés*, C. R. Acad. Sci. Paris, Sér. I. **333** (2001) 389-394.
8. E. Faou, *Elasticity on a thin shell : Formal series solution*, Asympt. Anal. **31** (2002) 317-361.
9. F. Castella, P. Chartier and E. Faou, *Analysis of a Poisson system with boundary conditions*, C. R. Acad. Sci. Paris, Sér. I. **336** (2003) 703-708.
10. M. Dauge, E. Faou and Z. Yosibash : *Plates and shells : Asymptotic expansions and hierarchical models*. Chapter 8, Vol I of the Encyclopedia for Computational Mechanics. Edited by Erwin Stein, René de Borst, Thomas J.R. Hughes (2004).
11. F. Castella, P. Chartier, E. Faou, D. Bayart, F. Leplingard and C. Martinelli, *Raman Laser Modeling : Mathematical and Numerical Analysis*, Math. Model. Numer. Anal. (M2AN) **38** (2004) 457-475.
12. E. Cancès, F. Castella, P. Chartier, E. Faou, C. Le Bris, F. Legoll and G. Turinici, *High-order averaging schemes with error bounds for thermodynamical properties calculations by molecular dynamics simulations*, J. Chem. Phys. **121** (2004) 10346-10355.
13. E. Faou, *Multiscale expansions for linear clamped elliptic shells*, Comm. P.D.E. **29** Vol. 11 & 12 (2004) 1799-1845 .
14. F. Leplingard, C. Martinelli, S. Borne, L. Lorcy, T. Lopez, D. Bayart, F. Castella, P. Chartier and E. Faou, *Modeling of multi-wavelength Raman fiber lasers using a new and fast algorithm*, IEEE Photonics Technology Letters **16** (2004) 2601-2603.

15. E. Faou, E. Hairer and T.-L. Pham, *Energy conservation with non-symplectic methods : Examples and counter-examples*, BIT **44** (2004) 699–709.
16. E. Cancès, F. Castella, P. Chartier, E. Faou, C. Le Bris, F. Legoll and G. Turinici, *Long-time averaging for integrable Hamiltonian dynamics*, Numer. Math. **100** (2005) 211–232.
17. E. Faou and C. Lubich, *A Poisson integrator for Gaussian wavepacket dynamics*, Comput. Vis. Sci. **9** No 2 (2006) 45–55.
18. E. Faou, *Nosé-Hoover dynamics in a shaker*, J. Chem. Phys. **124** (2006) 184104.
19. P. Chartier, E. Faou and A. Murua, *An algebraic approach to invariant preserving integrators : The case of quadratic and Hamiltonian invariants*, Numer. Math. **103** No 4 (2006) 575–590.
20. G. Dujardin and E. Faou, *Long-time behaviour of splitting methods applied to the linear Schrödinger equation*, C. R. Acad. Sci. Paris, Sér. I. **344** (2007) 89–92.
21. G. Dujardin and E. Faou, *Normal form and long time analysis of splitting schemes for the linear Schrödinger equation with small potential*, Numer. Math. **106** No 2 (2007) 223–262.
22. P. Chartier and E. Faou, *Geometric integrators for piecewise smooth Hamiltonian systems*. Math. Model. Numer. Anal. (M2AN) **42** (2008) 223–241.
23. P. Chartier and E. Faou, *A simple proof of the existence of adiabatic invariants for perturbed reversible problems*. J. Phys. A : Math. Theor. **41** No 47 (2008) 475204.
24. E. Faou and V. Gradinaru : *Gauss-Hermite wavepacket dynamics : convergence of the spectral and pseudo-spectral approximation*. IMA J. Numer. Anal. **29** (2009) 1023–1045.
25. E. Faou, *Analysis of splitting methods for reaction-diffusion problems using stochastic calculus*. Math. Comp. **78** (2009) 1467–1483.
26. F. Castella, P. Chartier and E. Faou, *An averaging technique for highly-oscillatory Hamiltonian problems*. SIAM J. Numer. Anal. **47** No 4 (2009) 2808–2837.
27. E. Faou and T. Lelièvre, *Conservative stochastic differential equations : Mathematical and numerical analysis*. Math. Comp. **78** (2009) 2047–2074.
28. E. Faou, V. Gradinaru and C. Lubich, *Computational semi-classical quantum dynamics with Hagedorn wavepackets*. SIAM J. Sci. Comp. **31** No 4 (2009) 3027–3041.
29. A. Debussche and E. Faou, *Modified energy for split-step methods applied to the linear Schrödinger equation*. SIAM J. Numer. Anal. **47** No 5 (2009) 3705–3719
30. M. Dauge and E. Faou, *Koiter estimate revisited*. Math. Models Methods Appl. Sci. (M3AS) **20** No 1 (2010) 1–42.
31. E. Faou, B. Grébert and E. Paturel, *Birkhoff normal form for splitting methods applied to semi linear Hamiltonian PDEs. Part I : Finite dimensional discretization*. Numer. Math. **114** (2010) 429–458.

32. E. Faou, B. Grébert and E. Paturol, *Birkhoff normal form for splitting methods applied to semi linear Hamiltonian PDEs. Part II : Abstract splitting*. Numer. Math. **114** (2010) 459–490.
33. E. Faou and B. Grébert, *Quasi invariant modified Sobolev norms for semi linear reversible PDEs*. Nonlinearity **23** (2010) 429–443
34. M. Dauge, E. Faou and V. Péron, *Comportement asymptotique à haute conductivité de l'épaisseur de peau en électromagnétisme*. C. R. Acad. Sci. Paris, Sér. I. **348** (2010) 385–390.
35. P. Chartier, E. Darrigrand and E. Faou, *A Regular Fast Multipole Method for geometric numerical integrations of Hamiltonian systems*. BIT **50** (2010) 23–40.
36. G. Caloz, M. Dauge, E. Faou and V. Péron, *On the influence of the geometry on skin effect in electromagnetism*. Comput. Methods Appl. Mech. Engrg. **200** (2011) 1053–1068.
37. N. Champagnat, C. Chipot and E. Faou, *Reconciling alternate methods for the determination of charge distributions : A probabilistic approach for high-dimensional least-squares approximations*. J. Math. Chem. **49** (2011) 296
38. E. Faou and B. Grébert, *Hamiltonian interpolation of splitting approximations for nonlinear PDEs*. Found. Comput. Math. **11** (2011) 381–415
39. R. Carles and E. Faou, *Energy cascades for NLS on the torus*. To appear in Discrete Contin. Dyn. Syst. (DCDS-A).

Paper in revision

40. A. Debussche and E. Faou, *Weak backward error analysis for SDEs*. In revision in SIAM J. Numer. Anal.

Submitted papers

41. E. Faou and B. Grébert, *Resonances in long time integration of semi linear Hamiltonian PDEs*.
42. E. Faou and B. Grébert, *A Nekhoroshev type theorem for the nonlinear Schrödinger equation on the torus*.
43. N. Crouseilles and E. Faou, *Approximated travelling wave solutions to the 2D Euler equation on the torus*.
44. E. Faou, L. Gauckler and C. Lubich, *Sobolev stability of plane wave solutions to the cubic nonlinear Schrödinger equation on the torus*.
45. N. Crouseilles, E. Faou and M. Mehrenberger, *High order Runge-Kutta-Nyström splitting methods for the Vlasov-Poisson equation*.

Other publications

46. G. Dujardin and E. Faou, *Sobolev estimates for splitting schemes applied to the linear Schrödinger equation*, Mathematisches Forschungsinstitut Oberwolfach Report No. 14/2006.
47. P. Chartier and E. Faou, *A numerical method for Hamiltonian systems based on piecewise smooth space approximations*, Mathematisches Forschungsinstitut Oberwolfach Report No. 14/2006.
48. G. Dujardin and E. Faou, *Qualitative behavior of splitting methods for the linear Schrödinger equation in molecular dynamics*, ESAIM Proc. 22. (2007) 234–239.

Ph.D Thesis and Habilitation degree

49. Ph.D Thesis : *Développements asymptotiques dans les coques minces linéairement élastiques*, Thèse No. 2354, Mention Mathématiques, Université de Rennes I, Juin 2000.
50. Habilitation document : *Some geometrical aspects in shell theory and in numerical integration of hamiltonian systems*. Thèse d’habilitation, Université de Rennes I, 16 octobre 2007.