

# CURRICULUM VITAE

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## **Name and Address:**

Stéphane Lafortune

Department of Mathematics  
College of Charleston  
Robert Scott Small Building, Room 339  
Charleston, SC, 29424, USA  
(843) 953-5869  
lafortunes@cofc.edu  
<http://lafortunes.people.cofc.edu/>

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## **Education:**

- 1996 - 2000 : Université de Montréal and Université Paris VII  
Ph.D. in Physics  
Advisors: Pavel Winternitz and Jean-Pierre Gazeau
  - 1994 - 1996 : Université de Montréal  
Masters degree in Physics
  - 1990 - 1994 : Université de Sherbrooke  
Bachelors degree in Physics
  - 1993 : Université de Montréal  
Minor degree in Mathematics
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## **Research Interests**

My research interests include nonlinear wave theory and integrable systems. I am particularly interested in the stability of coherent structures in partial differential equations (PDE). I make use of Hamiltonian structures and the Evans function technique to study the stability of solutions to PDEs appearing in the description of elastic materials, flame propagation and other applications. As far as integrable systems are concerned, I am mainly interested in integrability detectors for continuous, discrete, and ultra-discrete equations.

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## Research Grants

*Waves traveling along classical and quantum vortices*

NSF Standard Grant to be submitted in November 2014, \$157,194.

*RUI: Stability analysis for soliton solutions of the Vortex Filament Equation and beyond*

NSF Standard Grant No. DMS-0908074, \$137,721, 2009-2013.

*RUI: Existence and stability of coherent structures with applications to elasticity*

NSF Standard Grant No. DMS-0509622, \$88,344, 2005-2009.

*Stability properties of light propagating in fiber optics*

College of Charleston faculty grant, \$2,000, Summer 2012.

*Stability properties of light propagating in fiber optics*

College of Charleston faculty grant, \$4,000, Summer 2008.

*Stability of deformations of elastic rods*

College of Charleston faculty grant, \$3,200, Summer 2005.

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## Employment

- Full Professor, Department of Mathematics, College of Charleston since 2014.
  - Associate Professor, Department of Mathematics, College of Charleston since 2008.
  - Assistant Professor, Department of Mathematics, College of Charleston, 2004-2008.
  - Hanno Rund Post-Doctoral Fellow in the Department of Mathematics, University of Arizona, 2002-2004.
  - Visiting Assistant Professor in the Department of Mathematics, University of Arizona, 2000-2002.
  - NSERC (National Science and Engineering Research Council of Canada) Post-Doctoral Fellowship 2000-2002 (CDN\$35,000 per year) at the University of Arizona.
  - Several PhD scholarships mainly from NSERC of Canada and FCAR of Québec between 1995 and 2000.
  - Scholarship that paid for a four-month stay in Paris every year. It was part of the France-Québec *dual advisor* program that enabled me to obtain a PhD from both Université de Montréal and Université Paris VII.
  - Teaching assistant at the Université de Montréal between 1995 and 2000.
  - Undergraduate research assistant at *I.N.R.S.-énergie et matériaux* (Varenes, Québec, Canada) in theoretical plasma physics in Spring 1992.
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## Teaching Experience

- Spring 2014: Contemporary Math. with Applications (Math103), College of Charleston.
- Spring 2014: Ordinary Differential Equations (Math323), College of Charleston.
- Fall 2013: Partial Differential Equations (Math423/523\*), College of Charleston.
- Fall 2013: Math103, College of Charleston.
- Summer 2013: Math103, College of Charleston.
- Spring 2013: Three sections of Math103, College of Charleston.
- Fall 2012: First Year Seminar on Math. Physics (FYSM144), College of Charleston.
- Spring 2012: Two sections of Math103, College of Charleston.
- Spring 2012: Mathematical Methods for Physicists (Math480/580\*), College of Charleston.
- Spring 2012: Two sections of Math103, College of Charleston.
- Fall 2011: Two sections of FYSM144, College of Charleston.
- Spring 2011: Two sections of Math103, College of Charleston.
- Spring 2011: Ordinary Differential Equations (Math323), College of Charleston.
- Spring 2010: Two sections of Math103, College of Charleston.
- Fall 2009: Two sections of Math103 and and one of Math323, College of Charleston.
- Spring 2009: Two sections of Math103, College of Charleston.
- Fall 2008: Partial Differential Equations (Math423/523\*), College of Charleston.
- Fall 2008: Two sections of Math103, College of Charleston.
- Spring 2008: Symmetry Methods for Diff. Equ. (Math580\*), College of Charleston.
- Spring 2008: Two sections of Math103, College of Charleston.
- Fall 2007: Ordinary Differential Equations (Math323), College of Charleston.
- Fall 2007: Two sections of Math103, College of Charleston.
- Spring 2007: Two sections of Calculus I (Math120), College of Charleston.
- Fall 2006: Math103, College of Charleston.
- Fall 2006: PDEs (Two sections: Math423 and Math523\*), College of Charleston.
- Spring 2006: Symmetry Methods for Diff. Equ. (Math480/580\*), College of Charleston.
- 2005-2006: Three sections of Math120, College of Charleston.
- Spring and Fall 2005: Ordinary Differential Equations (Math323), College of Charleston.
- 2004-2005: Five sections of College Algebra (Math101), College of Charleston.
- Falls 2000, 2001 and 2003: Calculus I (Math124), University of Arizona.
- Summers 2002 and 2003, Fall 2002: Calculus II (Math129), University of Arizona.
- Spring 2003: Advanced Mathematics for Engineers (Math322), University of Arizona.
- Between 1995 and 2000, Teaching assistant at the Université de Montréal for several Physics and Mathematics courses.

\* Graduate course

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## Research and independent studies with students

- Master's thesis co-advisor for Peter McLarnan at Miami University in Ohio, September 2011 to August 2013.
  - I did eight independent studies with undergraduate students on advanced topics: Summer 2014, Spring 2013, Fall 2012, 2 in Fall 2011, Spring 2008, Summer 2008, Spring 2007.
  - Undergraduate research project *Stability of Peakons* with Hunter Moss (summers 2011 and 2012), J Seymour (Summer 2011), and Shikha Chaurasia (Summer 2012).
  - Master's thesis advisor for Elena Fenici, September 2010 to December 2011.
  - Undergraduate research project *Linear Stability of solitary wave solution to KdV-Burgers equations* with Robert Vandermolen, May to December 2010.
  - Undergraduate research project *Linear Stability of Vortex Filaments* with Scotty Keith, 2007-2009.
  - Undergraduate research project *A study of the Evans function technique* with Kathryn Pedings, 2006-2007.
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## Service to the scientific community

- Referee work for *Proceedings of the Royal Society A*, *SIAM J. Appl. Math.*, *J. Math. Phys.*, *Eur. J. Appl. Math.*, *J. Phys. A*, *Physica D*, *Discrete Cont. Dyn. A*, and *Int. J. Modern Phys. C*.
- Co-organizer of the minisymposium *Existence and stability of coherent structures* part of the *SIAM Conference on Nonlinear Waves* held in Cambridge (August 2014).
- Co-organizer of the minisymposium *Existence and stability of traveling wave solutions* as part of the *SIAM Conference on Applications of Dynamical Systems* held in Snowbird, Utah (May 2013).
- Co-organizer of the minisymposium *Existence and Stability of Nonlinear Waves in Coupled Systems* as part of the *SIAM Conference on Applications of Dynamical Systems* held in Snowbird, Utah (May 2011).
- Co-organizer of the minisymposium *Symmetry and Integrability of Discrete and Ultradiscrete Systems* as part of the *The IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena* held in Athens, Georgia (April 2011).
- Co-organizer of the minisymposium *Discrete Integrable Systems* as part of the *8th AIMS International Conference on Dynamical Systems, Differential Equations and Applications* held in May 2010 in Dresden, Germany.
- Co-organizer of the minisymposium *Discrete and Ultradiscrete Integrable Systems* as part of the *2008 Nonlinear Evolution Equations and Wave Phenomena: Computation and Theory Conference* held in Athens, Ga (March 2009).

- Co-organizer of the minisymposium *Periodic Problems in Soliton Equations* as part of the *Nonlinear Waves: Theory and Applications Conference* held in Beijing (2008).
- Guest editor of a special issue of *Journal of Physics A* dedicated to the subject of *Symmetries and Integrability of Difference Equations* as featured at the SIDE VII meeting held in Melbourne in 2006. This issue was published in 2007.
- Organizer of the minisymposium *Discrete Integrable Systems: Theory and Applications* as part of the *2006 SIAM Conference on Nonlinear Waves and Coherent Structures* held in September 2006 in Seattle.
- Co-organizer of a mini-session entitled *Solitons and Integrability* as part of the *SIAM Southeastern Section Conference* held in Charleston in March 2005.
- Organizer of the two-day applied mathematics conference *Los Alamos Days* held at the University of Arizona in February 2001. This conference is held once a year either in Tucson or in Los Alamos.

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### Other service

- Member of the Compensation Committee of the College of Charleston, 2013-2015.
- Member of the T&P Committee of the College of Charleston, 2012-2013.
- Member of the R&D Math. Dept. committee, College of Charleston, 2009-2013.
- Member of the Faculty Welfare Committee of the College of Charleston, 2011-2012.
- Member of the Math. Dept. hiring committee, College of Charleston, 2009-2012.
- Member of the Academic Planning Committee, College of Charleston, 2009-2010.
- Member of the Privacy Committee of the College of Charleston, 2008-2009
- Member of the Faculty Welfare Committee, College of Charleston, 2007-2009.
- Organizer of the Math. weekly Colloquium, College of Charleston, 01/2007 to 05/2008.
- Head of the Math. Dept. R&D committee, College of Charleston, 01/2007 to 05/2008.
- Member of the Math. Dept. hiring committee, College of Charleston, 2005-2006.
- Member of the 2005 and 2006 College-wide committee that evaluated the undergraduate research grant proposals at the College of Charleston.
- Organizer of the 2003-2004 Applied Math. weekly colloquium, University of Arizona.
- In 2001 I organized an informal series of seminars about the theory of classification of semi-simple Lie algebras based on the book *Introduction to Lie Algebras and Representation Theory* written by J.E. Humphreys. The participants were graduate students, a post-doc, and a professor.

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### Awards

- Selected as the Department of Mathematics candidate for the 2010 and for the 2011 College of Charleston Faculty Research Award and the 2012, 2013, and 2014 Teacher-Scholar Award.
  - Finalist for the Un. of Arizona *Excellence in Teaching* Awards for Summer 2002.
  - I was selected to be the candidate of the Université de Montréal for the NSERC (National Science and Engineering Research Council of Canada) 2000 Doctoral Prizes, the CMS (Canadian Mathematical Society) 2000 Doctoral prize, and the *Académie des Grands Montréalais* 2000 (doctoral prize for the city of Montreal).
  - Prize from the *Quebec Ministry of International Relations* for the best thesis done in the *dual advisor* program in 2000: \$700.
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## Publications in Refereed Journals

- 36 A. Ghazaryan, S. Laforune, and P. McLarnan, *Stability analysis for combustion fronts traveling in hydraulically resistant porous media*, submitted to *SIAM Journal of Applied Mathematics* (2014).
- 35 A.N.W. Hone and S. Laforune, *Stability of solutions for nonintegrable peakon equations*, *Physica D* **269**, 28–36 (2014).
- 34 S. Laforune, *Stability of solitons on vortex filaments*, *Physics Letters A* **377**, 766–769 (2013).
- 33 P. G. Kevrekidis, G. J. Herring, S. Laforune and Q. E. Hoq, *The higher-dimensional Ablowitz-Ladik model: from (non-) integrability and solitary waves to surprising collapse properties and more exotic solutions*, *Physics Letters A* **376**, 982-986 (2012).
- 32 A. Calini, S. Keith and S. Laforune, *Squared eigenfunctions and linear stability properties of closed vortex filaments*, *Nonlinearity* **24**, 3555-3583 (2011).
- 31 S. Laforune, J. Lega and S. Madrid, *Instability of local deformations of an elastic rod: numerical evaluation of the Evans function*, *SIAM Journal of Applied Mathematics* **71**, 1653–1672 (2011).
- 30 N. Joshi, S. Laforune, and A. Ramani, *Hirota bilinear formalism and ultra-discrete singularity analysis*, *Nonlinearity* **22**, 871–887 (2009).
- 29 T. Ivey and S. Laforune, *Spectral stability analysis for periodic traveling wave solutions of NLS and CGL perturbations*, *Physica D* **237**, 1750–1772 (2008).
- 28 A. Doliwa, R. Korhonen and S. Laforune, eds., *Symmetries and Integrability of Difference Equations: Special issue dedicated to the subject of the SIDE VII meeting, 10-14 July 2006*, *J. Phys. A* **40**, 12509-12810 (2007).
- 27 S. Balasuriya, G. Gottwald, J. Hornibrook, and S. Laforune, *High Lewis number combustion wavefronts: a perturbative Melnikov analysis*, *SIAM Journal on Applied Mathematics* **67**, 464-486 (2007).
- 26 A. Kasman and S. Laforune, *When is negativity not a problem for the ultradiscrete limit?*, *J. Math Phys.* **47**, 103510, 16 pages (2006).
- 25 N. Joshi and S. Laforune, *Integrable ultra-discrete equations and singularity analysis*, *Nonlinearity* **19**, 1295–1312 (2006).
- 24 S. Laforune, A. Goriely, and M. Tabor *The dynamics of stretchable rods in the inertial case*, *Nonlinear Dynamics* **43**, 173-195 (2006).
- 23 N. Joshi and S. Laforune, *How to detect integrability in Cellular Automata*, *J. Phys. A* **38**, L499-L504 (2005).
- 22 M.A. Agrotis, S. Laforune, and P.G. Kevrekidis, *Discrete version of the Korteweg-de Vries equation*, *Discrete Contin. Dyn. Syst., suppl.*, 22–29 (2005).
- 21 S. Laforune and J. Lega, *Spectral stability of local deformations of an elastic rod: Hamiltonian formalism*, *SIAM Journal of Mathematical Analysis* **36**, 1726-1741 (2005).
- 20 S. Laforune and A. Goriely, *Singularity confinement and algebraic integrability*, *Journal of Mathematical Physics* **45** (2004), 1191-1208.

- 19 S. Lafortune and J. Lega, *Instability of local deformations of an elastic rod*, Physica D **82** (2003), 103-124.
  - 18 S. Lafortune, A. Ramani and B. Grammaticos, *The last remake of the Gambier mapping*, Physica A **317** (2003), 383-390.
  - 17 A. Ramani, B. Grammaticos and S. Lafortune, *The discrete Chazy III system of Labrunie-Conte is not integrable*, Journal of Physics A **35** (2002), 7943-7946.
  - 16 S. Lafortune, A.S. Carstea, A. Ramani, B. Grammaticos and Y. Ohta, *Integrable third-order mappings and their growth properties*, Regular and Chaotic Dynamics **4** (2001), 443-448.
  - 15 S. Lafortune, S. Tremblay and P. Winternitz, *Symmetry classification of diatomic molecular chains*, J. Math Phys. **42** (2001), 5341-5357.
  - 14 S. Lafortune, B. Grammaticos, A. Ramani and P. Winternitz, *Discrete systems related to equations of the Painlevé-Gambier classification*, Phys. Lett. A **270** (2000), 55-61.
  - 13 L. Martina, S. Lafortune and P. Winternitz, *Symmetries of Generalized Toda field theories II: symmetry reduction*, J. Phys. A **33** (2000), 6431-6446.
  - 12 S. Lafortune, P. Winternitz and L. Martina, *Point symmetries of generalized Toda field theories*, J. Phys. A **33** (2000), 2419-2435.
  - 11 A. Ramani, B. Grammaticos, S. Lafortune and Y. Ohta, *Linearizable mappings and the low-growth criterion*, J. Phys. A **33** (2000), L287-L292.
  - 10 D. Gómez-Ullate, S. Lafortune and P. Winternitz, *Symmetries of Discrete Dynamical systems involving two species*, J. Math Phys. **40** (1999), 2782-2804.
  - 9 S. Lafortune, B. Grammaticos and A. Ramani, *Discrete and continuous linearisable equations*, Physica A **268** (1999), 129-141.
  - 8 B. Grammaticos, A. Ramani and S. Lafortune, *Schlesinger transformations for linearisable equations*, Lett. Math Phys. **46** (1998), 131-145.
  - 7 S. Lafortune, P. Winternitz and C. R. Menyuk, *Solutions to the optical cascading equations*, Phys. Rev. E **58** (1998), 2518-2525.
  - 6 B. Grammaticos, A. Ramani, K. M. Tamizhmani and S. Lafortune, *Again, linearisable mappings*, Physica A **252** (1998), 138-150.
  - 5 B. Grammaticos, A. Ramani and S. Lafortune, *The Gambier mapping, revisited*, Physica A **253** (1998), 260-270.
  - 4 S. Lafortune, B. Grammaticos and A. Ramani, *Constructing third order integrable systems: the Gambier approach*, Inverse Problems **14** (1998), 287-298.
  - 3 S. Lafortune, *Superposition formulas for pseudo-orthogonal matrix Riccati equations*, Can. J. Phys. **75** (1997), 345-355.
  - 2 S. Lafortune and P. Winternitz, *Superposition formulas for pseudounitary matrix Riccati equations*, J. Math Phys. **37** (1996), 1539-1550.
  - 1 R. Marchand, S. Lafortune and X. Bonnin, *Average ion approximation for modelling impurity transport in tokamaks*, Comp. Phys. Comm. **76** (1993), 203-214.
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## Contributions to Conference Proceedings

- 4 S. Lafortune, A. Ramani, B. Grammaticos, Y. Ohta and K. M. Tamizhmani, *Blending two discrete integrability criteria: singularity confinement and algebraic entropy*, Bäcklund & Darboux Transformations: The Geometry of Soliton Theory, AARMS–CRM Workshop (Halifax, 1999) (A. Coley et al. (eds)), CRM Proceedings & Lecture Notes, vol. 29, Amer. Math. Soc., Providence, RI, 2001, pp. 299–311.
  - 3 S. Lafortune, B. Grammaticos and A. Ramani, *Linearisable systems and the Gambier approach*, SIDE III - Symmetry and Integrability of Difference Equations (D. Levi and O. Ragnisco (eds)) (Conference held in Italy, 1998), CRM Proc. Lectures notes, vol.25, Amer. Math Soc., Providence, RI (2000), 255-261.
  - 2 A. Ramani, B. Grammaticos and S. Lafortune, *A Study of the Continuous and Discrete Gambier Systems*, SIDE III - Symmetry and Integrability of Difference Equations (D. Levi and O. Ragnisco (eds)) (Conference held in Italy, 1998), CRM Proc. Lectures notes, vol.25, Amer. Math Soc., Providence, RI (2000), 367-379.
  - 1 D. Gómez-Ullate, S. Lafortune and P. Winternitz, *Symmetry Classification of Systems of Differential-Difference Equations*, SIDE III - Symmetry and Integrability of Difference Equations (D. Levi and O. Ragnisco (eds)), CRM Proc. Lectures notes, vol.25, Amer. Math Soc., Providence, RI (2000), 167-172.
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## Thesis reviewing

- 1) Spring 2010: Master's thesis in Math (Coll. of Charleston) submitted by S. Nelson.
  - 2) Fall 2008: PhD thesis in Math (Un. of Arizona) submitted by M. Beauregard.
  - 3) Spring 2008: Master's thesis in Math (Sydney Un.) submitted by J. Hornibrook
  - 4) Spring 2008: Master's thesis in Math (Coll. of Charleston) submitted by K. Eperson.
  - 5) Spring 2007: Master's thesis in Math (Coll. of Charleston) submitted by L. Ingram.
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## A Selection of Recent Talks

- *SIAM Conference on Nonlinear Waves*, Cambridge (UK) (**August '14**). Title: *Stability of Traveling Waves on Vortex Filaments*. Part of the *Spectral and Geometric Methods in Stability of Waves and Patterns* minisymposium.
- *University of Massachusetts Math Colloquium* (**January '14**). Title: *Stability of solutions to peakon equations*.
- *'13 SIAM Conference on Dynamical Systems*, Utah (**May '13**). Title: *Stability of solutions for nonintegrable peakon equations*. Part of the *Existence and Stability of Traveling Wave Solutions* minisymposium.
- *Miami University Math Colloquium* (**Nov. '12**). Title: *Stability of peakon solutions*.
- *'12 Fall AMS Central Sectional Meeting*, Ohio (**October '12**). Title: *Stability of solutions for nonintegrable peakon equations*. Part of the *Nonlinear Waves and Patterns* minisymposium.
- *'12 AMS Spring Central Section Meeting*, Kansas (**March '12**). Title: *Stability of solutions for nonintegrable peakon equations*. Part of the *Dynamics and Stability of Nonlinear Waves* minisymposium.
- *'11 SIAM Conference on Dynamical Systems*, Utah (**May '11**). Title: *Stability Analysis for Closed Curve Solutions to the Vortex Filament Equation*. Part of the *Existence and Stability of Nonlinear Waves in Coupled Systems* minisymposium.
- *Seventh IMACS International Conference on Nonlinear Evolution Equations and Wave Phenomena*, Athens, Ga (**April '11**). Title: *Instability of local deformations of an elastic filament: numerical computation of the Evans function*. Part of the *Symbolic and Numerical Computation in the Study of Nonlinear Differential and Difference Equations* minisymposium.
- *UNC Math Colloquium* (**Dec. '10**). Title: *Linear Stability for Solutions to the Vortex Filament Equation*.
- *University of Arizona Math Colloquium* (**October '10**). Title: *Linear Stability for Solutions to the Vortex Filament Equation*.
- *SIAM Conference on Nonlinear Waves*, Philadelphia (**August '10**). Title: *Linear Stability for Solutions to the Vortex Filament Equation*. Part of the *Recent Developments in Analysis of Traveling Waves* minisymposium.
- *8th AIMS International Conference on Dynamical Systems, Differential Equations and Applications*, Dresden, Germany (**May '10**). Title: *Linear Stability for Solutions to the Vortex Filament Equation*. This talk was given as part of the *Spectral, Linear and Nonlinear Stability of Coherent Structures* minisymposium.
- *University of Kansas Math Colloquium* (**April '10**). Title: *Stability Analysis of Persisting Periodic Solutions to a Complex Ginzburg-Landau Perturbation of NLS*.
- *NC State University Differential Equations Seminar* (**March '10**). Title: *Stability Analysis of Persisting Periodic Solutions to a CGL Perturbation of NLS*.