

---

**Francesco Fedele, Ph.D**  
Georgia Institute of Technology,  
Dept. of Civil & Environmental Engineering  
210 Technology Circle  
Savannah, Georgia USA

phone: (+01) 912-966-6785

E-mails: [francesco.fedele@gtsav.gatech.edu](mailto:francesco.fedele@gtsav.gatech.edu)

URL: <http://www.gtsav.gatech.edu/cee/faculty/fedele.html>

# Francesco Fedele, Ph.D.

---

## EDUCATION

### **2004 Ph.D. in Civil & Environmental Engineering**

University of Vermont Burlington VT USA: co-advisors J.P. Laible and M.J. Eppstein.

**Ph.D. Thesis "Novel Numerical Techniques for problems in Engineering Science"**

### **1998 M.S. in Civil Engineering (*magna cum laude*)**

UNIVERSITY MEDITERRANEA Dept. of Mechanics and Materials– Reggio Calabria, ITALY.

**Master Thesis "Analytical study of the interaction water waves & submerged horizontal cylinders"**

(in Italian).

---

## RESEARCH INTERESTS

**Fluid mechanics:** statistics of non-linear water waves, hydrodynamics stability, multi-phase flows.

**Numerical analysis:** FEM, BEM and collocation methods

**Inverse problems:** fluorescence optical tomography for recognition of breast cancer by adjoint methods and boundary element methods.

**Applied mathematics:** transition to turbulence and extreme events, solitons and defects in photonic lattices

---

## POSITIONS

- |                      |   |
|----------------------|---|
| 01/07/2007-          | <b>Assistant professor</b> , Georgia Institute of Technology,<br>School of Civil & Environmental Engineering, Savannah Campus |
| 6/01/2005-01/06/2007 | <b>Post Doctoral associate</b> , GMAO & GEST, NASA Goddard Space Flight Center, Greenbelt, Maryland USA                       |
| 1/1/2005-5/31/2005   | <b>Post Doctoral associate</b> , Dept. Mechanical Engineering, University of Vermont VT USA                                   |
| 1/1/2000-12/31/2004  | <b>Graduate research assistant</b> , Dept. Civil Engineering, University of Vermont VT USA                                    |

---

## RESEARCH PROJECTS

01/07/2007-

" **Interaction of ocean waves with turbulent wind** "

" **Rogue waves in oceanic turbulence** "

" **Hydrodynamic pipe turbulence and transition** "

" **Fluorescence Optical tomography** "

"**Stereo-Video Imagery Technology for Spatial and Temporal Wave Measurements**"

6/01/2005-01/07/2007

"**Data assimilation studies with a quasi-geostrophic weather model** "

1/1/2005-5/31/2005

" **Transition to turbulence in pulsatile pipe flows** "

6/1/2004-1/1/2005

" **Bandgap structures in two-dimensional photonic lattices** "

6/1/2003-6/1/2004

" **Boundary element technique for Fluorescence tomography** "

6/1/2002-5/31/2003

" **Dispersion properties of Lake Champlain (Vermont USA) by inverse modelling** "

9/1/2001-12/31/2001

" **Adjoint sensitivities in optical fluorescence tomography** "

5/1/2001-8/31/2001

" **Finite element method for optical imaging for detection of breast cancer**"

5/1/2000-12/31/2000

" **Localized COLlocation Method for the diffusion-advection equations (LOCOM)**"

---

## PEER-REVIEWED PUBLICATIONS

- [1] **Fedele F.** , Tayfun, M.A., 2008 "**On nonlinear wave groups and crest statistics** " Journal of Fluid Mechanics (in press)
- [2] **Fedele F.** 2008 "**On the statistics of oceanic waves**" International Journal of Reliability and Safety (in press)
- [3] **Fedele F.** 2008 "**Rogue wave in oceanic turbulence** " PHYSICA D 237, 14-17:2127-2131
- [4] Tayfun, M.A., **Fedele F.** 2007 "**Wave height distributions and nonlinear effects**" Ocean Engineering **34**, 1631-1644
- [5] **Fedele F.** 2007 "**Explaining extreme waves by a theory of Stochastic wave groups**" Computer and Structures **85**, 291-303, special issue in probabilistic computational mechanics
- [6] **Fedele F.** 2006 "**On wave groups in a Gaussian Sea** " Ocean Engineering, Volume 33, Issues 17-18;2225-2239
- [7] **Fedele F** & Hitt DL. 2006. **Transport, Growth and Stability of Disturbances in Weakly Rarefied Channel Flows.** J. Comp. Theo. Nanoscience Vol. (3), 1-9.
- [8] **Fedele F.** 2006 "**Extreme Events in nonlinear random seas**" J. of Offshore Mechanics and Arctic Eng. ASME, **128**, 11-16.
- [9] **Fedele F.** & D. Hitt, 2005 **Linear Stability of Slip Flows in Microchannels.** Far East Journal Applied Mathematics 21(1), 31-41
- [10] **Fedele, F.** 2005. **Successive wave crests in Gaussian seas.** Probabilistic Engineering Mechanics, vol. 20, Issue 4, 355-363.
- [11] **Fedele F.** , Eppstein M. , Laible J.P.,Godavarty A. & Sevick-Muraca E.M. "**Fluorescence Photon migration by the Boundary Element Method**" Journal of Computational Physics vol. 210, issue 1 pp. 109-132, 2005
- [12] **Fedele F.**, J. Yang & Z. Chen " **Defect modes in 1D Photorefractive Lattices** " Optics Letters vol. 30, no. 12, pp. 1506-1508, 2005
- [13] **Fedele F.**, J. Yang & Z. Chen 2005 "**Properties of defect modes in light-induced photonic lattices**" Studies in Applied Mathematics vol. 115, issue 2 pp. 279-301(focus issue on 'Nonlinear Wave Phenomena in Periodic Photonic Structure' )
- [14] **Fedele F.** , Eppstein M. , Laible J.P.,Godavarty A. & Sevick-Muraca E.M. 2005 "**Fluorescence Photon migration by the Boundary Element Method**" Journal of Computational Physics vol. 210, issue 1 pp. 109-132

- [15] Arena F. , **Fedele F.** 2005 **Non-linear space-time evolution of a high wave crest**. Journal Offshore Mechanics and Arctic Engineering (OMAE), vol. 127, issue 1, pp. 1-74
- [16] **Fedele F.**, Hitt D., Prabhu R.D. 2005 **Revisiting the stability of Pulsatile pipe flow** European J. of Mech. - B/Fluids, Vol. 24(2)
- [17] **Fedele F.**, Arena, F. 2005 **Weakly nonlinear Statistics of high Random waves** Physics of fluids, vol. 17, 026601
- [18] **Fedele F.**, Melissa McKay, G. F. Pinder and Guarnaccia J. 2004 **A single-degree of freedom Hermite Collocation for multi-phase flow and transport in porous media**. Inter. journal Numerical methods in fluids, vol. 44 pp. 1337-1354
- [19] Eppstein M. , **Fedele F.**, Laible J. P., Zhang C. , Godavarty A. & Sevick-Muraca E. M. 2003 **A comparison of exact and approximate adjoint sensitivities in fluorescence tomography**. IEEE Transactions on Medical Imaging, vol. 22, No. 10, pp. 1215-1222
- [20] Arena F., 2003 **Fedele F.** **Statistical Properties of Nonlinear Froude-Krylov Forces on Cylinders**. Inter. Journal of Offshore and Polar Engineering (IJOPE) Vol. 13, No. 2, June 2003, pp. 105-111
- [21] Arena, F. and **Fedele, F.** 2002 **A family of narrow-band non-linear stochastic processes for the mechanics of sea waves** . European Journal of Mechanics - B/Fluids, Vol.21, 1 pp 125-137
- [22] **Fedele F.**, Laible J. P. & Eppstein M. 2002 **Coupled complex adjoint sensitivities for frequency-domain fluorescence tomography: theory and vectorized implementation** . Journal of Computational physics, Vol. 187, Issue 2, pp. 597-619

---

## CONFERENCE PROCEEDINGS

### PEER-REVIEWED

- [1] Fedele, F ; Gallergo, G. ; Yezzi, A. & Benetazzo, A. 2008 “ **Understanding extreme waves via a variational wave acquisition stereo system**” Workshop ROGUE WAVES 2008, Oct 13-15, Brest, France
- [2] Fedele F., Gallego G., Benetazzo A., Yezzi A., Tayfun M.A. 2008 “**EULER CHARACTERISTICS & MAXIMA OF OCEANIC SEA STATES**” 31° Convegno di Idraulica e Costruzioni Idrauliche, Sept. 9-12, Perugia Italy.
- [3] **Fedele, F.**, Gallego, G., Benetazzo, A., Yezzi A. “**Wave Statistics and Spectra via a Variational Wave Acquisition Stereo System**” 27th International Conference on Offshore Mechanics and Arctic Engineering 2008 , Lisbon, Portugal paper OMAE2008-57160
- [4] Tayfun M.A, **Fedele, F.** 2008 “**Envelope and Phase Statistics of Large Waves**” 27th International Conference on Offshore Mechanics and Arctic Engineering 2008 , Lisbon, Portugal paper OMAE2008-57129
- [5] **Fedele F.** “**Rogue waves in oceanic turbulence**” 27th International Conference on Offshore Mechanics and Arctic Engineering 2008 , Lisbon, Portugal paper OMAE2008-57027
- [6] Tayfun, A., **Fedele F.** “**Expected shape of extreme waves in sea storms**” Proceedings of the 26th International Conference on Offshore Mechanics and Arctic Engineering, San Diego , USA , 10-15 June 2007
- [7] **Fedele F.** & D. Hitt “**Linear Stability and Growth of Disturbances in Weakly-Rarefied Pulsatile Flows**”, 59th Annual Meeting of the APS Division of Fluid Dynamics, November 19-21, 2006, Tampa Bay, Florida, USA
- [8] **Fedele F.** & Tayfun A. **EXPLAINING FREAK WAVES BY A STOCHASTIC THEORY OF WAVE GROUPS**. 25th International Conference on Offshore Mechanics and Arctic Engineering, Hamburg, Germany, 4-9 June 2006
- [9] Tayfun A. & **Fedele F.** **WAVE-HEIGHT DISTRIBUTIONS AND NONLINEAR EFFECTS**. 25th International Conference on Offshore Mechanics and Arctic Engineering, Hamburg, Germany, 4-9 June 2006
- [10] **Fedele F.** & D. Hitt “**On the Linear Stability of Weakly Rarefied Flows in Microchannels**”, 35th AIAA Fluid Dynamics Conference and Exhibit June 6 -9, 2005 Toronto, CA

- [11] **Fedele F., "A New Computational Paradigm for the Statistics of Extreme Events in Nonlinear Random Seas"**, Third M.I.T. Conference on Computational Fluid and Solid Mechanic June 14 - 17, 2005 at MIT, Cambridge, MA 02139 USA
- [12] **Fedele F & Hitt DL "Transport, Growth and Stability of Disturbances in Weakly Rarefied Channel Flows"**, Third M.I.T. Conference on Computational Fluid and Solid Mechanic June 14 - 17, 2005 at MIT, Cambridge, MA 02139 USA
- [13] **Fedele F., Arena F., Successive wave crests in Gaussian seas.** Proceedings of XIV International Offshore and Polar Engineering Conference (ISOPE) Toulon, FRANCE may 23-28 2004
- [14] **Fedele F. The occurrence of Extreme crests and the nonlinear wave-wave interaction in random seas** PROCEEDINGS of XIV International Offshore and Polar Engineering Conference (ISOPE) Toulon, FRANCE may 23-28 2004 (accepted also to the transaction journal IJOPE)
- [15] **Fedele F., Laible J. P. & Eppstein M. A boundary element solution of the coupled fluorescence diffusion equations** OSA Advances In Optical Imaging and Photon Migration (AOIPM) April 14-17 2004 Miami Beach FL (USA)
- [16] **Fedele F., Hitt D. On the statistics of Successive Wave Crest Heights in Gaussian seas.** Division of Fluid Dynamics 56th Annual Meeting November 23-25, 2003 East Rutherford, New Jersey (abstract)
- [17] **Fedele F., Hitt D. , Prabhu R.D. Revisiting the stability of pulsatile pipe flow.** Division of Fluid Dynamics 56th Annual Meeting November 23-25, 2003 East Rutherford, New Jersey (abstract)
- [18] **Fedele F. Tail probabilities of Successive Wave Crest Heights in Gaussian seas.** Proceedings of the Mediterranean Conference on modeling and simulation MCMS' 03 Reggio Calabria ITALY June 25-27, 2003
- [19] **Fedele F., Hitt. D., Prah R.D. A complete set of eigenfunctions for the stability of pulsatile pipe flow** Proceedings of the Mediterranean Conference on modeling and simulation MCMS' 03 Reggio Calabria ITALY June 25-27, 2003
- [20] **Laible J., Fedele F. P. & Eppstein M. A boundary element approach to optical and fluorescence tomography.** BIOS 2003 25-31 January 2003, San Jose, California, USA (SPIE 4955-33) (abstract)
- [21] **Fedele F., Laible J. P., & Eppstein M. Fluorescence tomography using the boundary element method** SIAM Conference on Computational Science and Engineering February 10-13, 2003 San Diego CA (abstract)
- [22] **Fedele F., Arena F. On the statistics of high non-linear random waves** Proceedings of XIII International Offshore and Polar Engineering Conference (ISOPE) Honolulu, Hawaii USA 25-30 may 2003
- [23] **Arena F. , Fedele F. Non-linear space-time evolution of a high wave crest** Proceedings of XXII Offshore Mechanics and Arctic Engineering (OMAE) Cancun, Mexico 8-13 june 2003
- [24] **Fedele F., Arena F. Statistical properties of non-linear forces of sea waves on a vertical wall.** 28<sup>th</sup> Convegno Nazionale idraulica e costruzioni idrauliche Potenza Italy September 16-19, 2002
- [25] **Mckay M., Pinder G. F., Fedele F., Guarnaccia J., Wu L. Multiphase groundwater flow and transport using a new localized collocation method (LOCOM)** XIV International Conference on Computational Methods in Water Resources June 23-28, 2002 Delft University of Technology The Netherlands
- [26] **Fedele F., Laible J. P., Pinder G. F. Localized-Adjoint-Finite-Element-Method for Sub-Grid Stabilization of Convection-dominated Transport on a Triangular Mesh.** XIV International Conference on Computational Methods in Water Resources June 23-28, 2002 Delft University of Technology The Netherlands
- [27] **Arena F., Fedele F. Non-linear wind-generated waves forces on a vertical wall.** 15<sup>th</sup> ASCE Engineering Mechanics Conferences june 2-5 2002 Columbia University New York NY

[28] Fedele F., Laible J. P., Eppstein M. **Generalized Adjoint Sensitivities of the Coupled Frequency Domain Fluorescence Diffusion Equations**, OSA Advances In Optical Imaging and Photon Migration (AOIPM) April 7-10 2002 Miami Beach FL (USA) pp. 371-373

[29] Arena F., Fedele F. **Intensity and Duration of Sea Storms off the California Coast**. Solutions to Coastal Disasters 2002 ASCE San Diego (CA) February 24-27 2002

[30] Melissa Mckay, G. F. Pinder, Fedele F. **LOCOM for Multi-phase Flow Code** AGU 2001 Fall Meeting December 2001 San Francisco CA (Poster)

[31] Arena F., Fedele F. **Statistical properties of non-linear Froude\_Krylov forces on cylinders**. ISOPE 2001 Stavanger Norway june 2001 Vol. III; pp. 264-271

[32] F. Fedele, G. F. Pinder, Li Wu , J. P. Laible, **Single-Degree-of-Freedom Collocation Solution to the Transport Equation**. AGU 2000 Fall Meeting December 15-19 December 2000 San Francisco CA (Poster)

[33] Arena F., Fedele F. **Non-linear effects for wind-generated waves**. XXVII Convegno di Idraulica e Costruzioni Idrauliche, Genoa Italy , september 2000 IV pp. 21-28 (*In Italian*)

[34] Fedele F., Tucciarelli T. **An efficient double order solution of the groundwater contaminant transport problem**. XIII Conference on Computational Methods in Water Resources, Calgary, Canada, June 25-29, 2000 Vol. 1 pp. 417-422.

---

## CONTRIBUTED & INVITED TALKS

**Fedele, F. ROGUE WAVES IN OCEANIC TURBULENCE AND SOLITONS IN AXISYMMETRIC TURBULENT FLOW: AN EXTREME VIEW**, 32nd SIAM Southeastern-Atlantic Section Conference (SIAM-SEAS 2008) Special Session: **Turbulence**; March 14-15 2008, University of Central Florida, Orlando (*Invited Speaker*)

**Fedele F. FREAK EVENTS EXPLAINED BY STOCHASTIC WAVE GROUPS**, contributed talk to Workshop: "Non-equilibrium statistical mechanics and turbulence", University of Warwick England July 15-21, 2006, ( sponsored by The Engineering and Physical Sciences Research Council (EPSRC) of UK )

**Fedele F. ON NONLINEAR STOCHASTIC WAVE GROUPS**, contributed talk to Isaac Newton Institute Workshop: "First-Passage and Extreme Value Problems in Random Processes" 26 June - 30 June 2006, ( Supported by the European Commission, Sixth Framework Programme - Marie Curie Conferences and Training Courses )

**Fedele F., Successive wave crests in a Gaussian sea**, Séminaire Européen de Statistique 2004 (Statistics of Spatio-Temporal Systems) December 12<sup>th</sup>-18<sup>th</sup>, 2004 Castle Höhenried, Bernried, near Munich, Germany (European Mathematical Society Summer School)

**Fedele F. Wave Groups and extreme events in a Gaussian sea**, University of Twente, dept. of Applied Mathematics, December 20 2004

**Fedele F., Laible J. P., Pinder G. F. An optimal Petrov-Galerkin method for convection-dominated transport equations**. MAXIMA 2002, IX Mexican American Exchange in Mathematics and its applications, Cuernavaca Morelos Mexico August 12-16, 2002 (abstract)

---

## AWARDS

[1] Young researcher scholarship for participation to the international conference : **"Euler Equations : 250 years on"** Aussois, France June 18-23, 2007, an event that will celebrate the tercentenary of the birth of Leonhard Euler, and also the 250th anniversary of the publication of his *Principes Généraux du Mouvement des Fluides* (General Principles of the Motion of Fluids). This article first introduced the celebrated Euler equations of fluid motion and arguably started modern hydrodynamics, which is still a very vigorous area of research with many applications and many open problems.

[2] Scholarship for participation to the workshop: "**Non-equilibrium statistical mechanics and turbulence**" University of Warwick England July 15-21, 2006, ( sponsored by The Engineering and Physical Sciences Research Council (EPSRC) of UK )

[3] Scholarship for participation to an Isaac Newton Institute Workshop: "**First-Passage and Extreme Value Problems in Random Processes**" 26 June - 30 June 2006, ( Supported by the European Commission, Sixth Framework Programme - Marie Curie Conferences and Training Courses )

[4] Scholarship for participation to Séminaire Européen de Statistique, December 12-18, 2004, (**Statistics of Spatio-Temporal Systems**) Castle Höhenried, Bernried, near Munich, Germany (European Mathematical Society Summer School)

---

#### PROVISIONAL PATENT

Eppstein, M.J., Laible, J.P, and Fedele, F. **New Boundary Element Method for Coupled Elliptic Partial Differential Equations with Specified Application to Fluorescence Tomography**, Provisional Patent Application Filed, October, 8, 2002

---

#### JOURNAL REVIEWS

European Journal of Mechanics-B/Fluids  
Numerical Methods for Partial Differential Equations  
Ocean Engineering

---

LANGUAGES Italian (*mother tongue*) , English (*fluent*), French, Spanish (*notions*)

---

COMPUTER SKILLS Programming Language: Fortran 77/90; Operating System: Windows NT 4.0, Windows 2000, Unix; Matlab, Mathcad, Mathematica and Maple.

---

PROFESSIONAL MEMBERSHIPS: ISOPE member, SIAM member , ASME member

---

**END OF CV**