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# Francesco Fedele

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## OBJECTIVE

Looking for a **job position** to apply my expertise in computational science and physics in order to provide innovative solutions to challenging problems

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## 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).**

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## 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

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## POSITIONS

6/01/2005- **Post Doctoral associate**, Global Modeling Assimilation Office, NASA Goddard Space Flight Center, USA  
1/1/2005-5/31/2005 **Post Doctoral associate**, dept. Mechanical Engineering, University of Vermont VT USA  
1/1/2000-12/31/2004 **Graduate research assistant**, dept. Civil Engineering, University of Vermont VT USA

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## RESEARCH PROJECTS

6/01/2005- " **Data assimilation studies with a quasi-geostrophic weather model** "  
Skill set: fluid mechanics, nonlinear wave theory, numerical methods.

1/1/2005-5/31/2005 " **Transition to turbulence in pulsatile pipe flows** "  
Skill set: fluid mechanics, hydrodynamic stability, nonlinear wave theory, numerical methods.

6/1/2004-1/1/2005 " **Bandgap structures in two-dimensional photonic lattices** "  
Skill set: Floquet's theory, Mathieu Equation, numerical methods.

6/1/2003-6/1/2004 " **Boundary element technique for Fluorescence tomography** "  
Skill set: Green function theory for system of elliptic differential equations, adjoint methods.

6/1/2002-5/31/2003 " **Dispersion properties of Lake Champlain (Vermont USA) by inverse modelling** "  
Skill set: Shallow water equations, finite element, inverse modeling .

9/1/2001-12/31/2001 " **Adjoint sensitivities in optical fluorescence tomography** "  
Skill set: Green function theory, adjoint based optimization, finite elements.

5/1/2001-8/31/2001 " **Finite element method for optical imaging for detection of breast cancer** "  
Skill set: Finite element method for elliptic differential equations.

5/1/2000-12/31/2000 " **Localized Collocation Method for the diffusion-advection equations (LOCOM)** "  
Skill set: Hermite Collocation methods, numerical analysis.

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TEACHING EXPERIENCE **Teaching assistant** at Dept. of Civil Engineering University of Vermont Structural analysis I, Static.

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## PEER-REVIEWED PUBLICATIONS

- [1] **Fedele F.** "On wave groups in a Gaussian Sea " Ocean Engineering 2006 ( in press)
- [2] **Fedele F.** "Explaining freak waves by Stochastic wave groups" Computer and Structures 2006, special issue in probabilistic computational mechanics ( in press)
- [3] **Fedele F** & Hitt DL. 2006. **Transport, Growth and Stability of Disturbances in Weakly Rarefied Channel Flows.** Special Journal Issue on Modeling Coupled and Transport Phenomena in Nanotechnology (in press)
- [4] **Fedele F.** "Extreme Events in nonlinear random seas" J. of Offshore Mechanics and Arctic Eng., ASME, **128**, 11-16.
- [5] **Fedele F.** & D. Hitt, 2005 **Linear Stability of Slip Flows in Microchannels.** Far East Journal Applied Mathematics 21(1), 31-41
- [6] **Fedele, F.** 2005. **Successive wave crests in Gaussian seas.** Probabilistic Engineering Mechanics, vol. 20, Issue 4, 355-363.
- [7] **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
- [8] **Fedele F.,** J. Yang & Z. Chen " **Defect modes in 1D Photorefractive Lattices** " Optics Letters vol. 30, no. 12, pp. 1506-1508, 2005
- [9] **Fedele F.,** J. Yang & Z. Chen "**Properties of defect modes in light-induced photonic lattices**" Studies in Applied Mathematics vol. 115, issue 2 pp. 279-301, 2005 (focus issue on 'Nonlinear Wave Phenomena in Periodic Photonic Structure' )
- [10] **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
- [11] Arena F. , **Fedele F.** **Non-linear space-time evolution of a high wave crest.** Journal Offshore Mechanics and Arctic Engineering (OMAE), 2005, vol. 127, issue 1, pp. 1-74
- [12] **Fedele F.,** Hitt D., Prabhu R.D. **Revisiting the stability of Pulsatile pipe flow** European J. of Mech. - B/Fluids, 2005, Vol. 24(2)
- [13] **Fedele F.,** Arena, F. **Weakly nonlinear Statistics of high Random waves** Physics of fluids 2005, vol. 17, 026601
- [14] **Fedele F.,** Melissa McKay, G. F. Pinder and Guarnaccia J. **A single-degree of freedom Hermite Collocation for multi-phase flow and transport in porous media.** Inter. journal Numerical methods in fluids 2004, vol. 44 pp. 1337-1354
- [15] Eppstein M. , **Fedele F.,** Laible J. P., Zhang C. , Godavarty A. & Sevick-Muraca E. M. **A comparison of exact and approximate adjoint sensitivities in fluorescence tomography.** IEEE Transactions on Medical Imaging 2003, vol. 22, No. 10, pp. 1215-1222
- [16] Arena, F. and **Fedele, F.** **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
- [17] **Fedele F.,** Laible J. P. & Eppstein M. **Coupled complex adjoint sensitivities for frequency-domain fluorescence tomography: theory and vectorized implementation .** Journal of Computational physics 2002, Vol. 187, Issue 2, pp. 597-619
- [18] Arena F., **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

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## PEER-REVIEWED CONFERENCE PROCEEDINGS

- [1] **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
- [2] 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
- [3] **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
- [4] **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

- [5] **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
- [6] **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
- [7] **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)
- [8] **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)
- [9] **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)
- [10] **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)
- [11] **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
- [12] **Fedele F., Hitt D., Prahu 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
- [13] **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)
- [14] **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)
- [15] **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
- [16] **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
- [17] **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
- [18] **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
- [19] **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
- [20] **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
- [21] **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
- [22] **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
- [23] **Melissa McKay, G. F. Pinder, Fedele F. LOCOM for Multi-phase Flow Code** AGU 2001 Fall Meeting December 2001 San Francisco CA (Poster)
- [24] **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

[25] 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)

[26] 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*)

[27] 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.

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#### CONTRIBUTED & INVITED TALKS

**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)

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#### AWARDS

[1] 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 )

[2] 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 )

[3] 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)

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#### 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

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#### JOURNAL REVIEWS

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

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

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

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PROFESSIONAL MEMBERSHIPS: ISOPE member, SIAM member , ASME member

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**END OF CV**