Edie Miglio

Curriculum Vitae

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Google Scholar Page

Academic experience

- **Politecnico di Milano**, Milano, Italy, *Associate Professor* **February 16th, 2015 - present**.
- **Politecnico di Milano**, Milano, Italy, *Assistant Professor* **March 1st, 2002 - February 15th 2015**.
- **National Centre for Computational Hydraulic and Engineering, University of Mississippi**, Oxford, MS, USA, *Visiting Research Scientist* **July, 2007 - December 2007** and **July, 2009 - September 2009**.

Education

2000	Ph.D. in Applied Mathematics	**Università degli Studi di Milano**, Milano, Italy Dissertation Title: "Mathematical and Numerical modelling for Environmental Applications", Advisor: Prof. A. Quarteroni
1997	M.S., Aerospace Engineering	**Politecnico di Milano**, Milano, Italy Dissertation Title: "A 3D Multilayer Finite-Element Shallow Water Model" (in italian), Advisor: Prof. A. Quarteroni

Publications

Refereed research papers

[J1] L. Fontana, E. Miglio, A. Quarteroni, and F. Saleri. A finite element method for 3D hydrostatic water flows. *Computing and Visualization in Science* **2**(2-3) (1999), 85–93. DOI: 10.1007/s007910050031.

[J2] E. Miglio, A. Quarteroni, and F. Saleri. Finite element approximation of quasi-3D shallow water equations. *Computer methods in applied mechanics and engineering* **174**(3) (1999), 355–369. DOI: 10.1016/S0045-7825(98)00304-1.

[J3] P. Causin and E. Miglio. Parallel computing for the simulation of 3D free surface flows in environmental applications. *Lecture Notes in Computer Science* **2474 LNCS** (2002), 78–88. DOI: 10.1007/3-540-45825-5_21.

[J4] P. Causin, E. Miglio, and F. Saleri. Algebraic factorizations for 3D non-hydrostatic free surface flows. *Computing and Visualization in Science* **5**(2) (2002), 85–94. DOI: 10.1007/s00791-002-0090-8.

[J5] M. Discacciati, E. Miglio, and A. Quarteroni. Mathematical and numerical models for coupling surface and groundwater flows. *Applied Numerical Mathematics* **43**(1) (2002), 57–74. DOI: 10.1016/S0168-9274(02)00125-3.

[J6] E. Miglio, A. Quarteroni, and F. Saleri. Coupling of free surface and groundwater flows. *Computers & fluids* **32**(1) (2003), 73–83. DOI: 10.1016/S0045-7930(01)00102-5.

[J7] E. Miglio, A. Quarteroni, and F. Saleri. Mathematical Modelling of Free Surface Flows. *Quaderni di Matematica* **10** (2003), 97–123.

[J8] F. Caliò, E. Miglio, G. Moroni, and M. Rasella. Integral $\lambda - \tau$ bivariate spline operators in computer graphics problems. *Studia Universitatis Babes-Bolyai Mathematics* **XLIX**(4) (2004), 43–52. http://www.cs.ubbcluj.ro/~studia-m/2004-4/calio.pdf.

[J9] S. Perotto, E. Miglio, and F. Saleri. A multiphysics strategy for free surface flows. *Lecture Notes in Computational Science and Engineering* **40** (2004), 395–402. DOI: 10.1007/3-540-26825-1_40.

[J10] E. Miglio, S. Perotto, and F. Saleri. Model coupling techniques for free-surface flow problems: Part I. *Nonlinear Analysis: Theory, Methods & Applications* **63**(5) (2005), e1885–e1896. DOI: 10.1016/j.na.2005.03.083.

[J11] E. Miglio, S. Perotto, and F. Saleri. Model coupling techniques for free-surface flow problems: Part II. *Nonlinear Analysis: Theory, Methods & Applications* **63**(5) (2005), e1897–e1908. DOI: 10.1016/j.na.2005.03.085.

[J12] L. Formaggia, E. Miglio, A. Mola, and N. Parolini. Fluid–structure interaction problems in free surface flows: Application to boat dynamics. *International journal for numerical methods in fluids* **56**(8) (2008), 965–978. DOI: 10.1002/fld.1583.

[J13] A. Decoene, L. Bonaventura, E. Miglio, and F. Saleri. Asymptotic derivation of the section-averaged shallow water equations for natural river hydraulics. *Mathematical Models and Methods in Applied Sciences* **19**(03) (2009), 387–417. DOI: 10.1142/S0218202509003474.

[J14] L. Formaggia, E. Miglio, A. Mola, and A. Montano. A model for the dynamics of rowing boats. *International journal for numerical methods in fluids* **61**(2) (2009), 119–143. DOI: 10.1002/fld.1940.

[J15] C. Leupi, E. Miglio, M. Altinakar, A. Quarteroni, and M. Deville. A 3D finite element model for free-surface flows. *Computers & Fluids* **38**(10) (2009), 1903–1916. DOI: 10.1016/j.compfluid.2009.05.003.

[J16] F. Caliò, E. Miglio, and M. Rasella. Curve fairing using integral spline operators. *International Journal for Numerical Methods in Biomedical Engineering* **26**(12) (2010), 1674–1686. DOI: 10.1002/cnm.1253.

[J17] L. Bonaventura, A. Iske, and E. Miglio. Kernel-based vector field reconstruction in computational fluid dynamic models. *International Journal for Numerical Methods in Fluids* **66**(6) (2011), 714–729. DOI: 10.1002/fld.2279.

[J18] E. Miglio and C. Sgarra. A finite element discretization method for option pricing with the Bates model. *SeMA Journal* **55**(1) (2011), 23–40. DOI: 10.1007/BF03322591.

[J19] M. Cuffaro and E. Miglio. Asymmetry of thermal structure at slow-spreading ridges: Geodynamics and numerical modeling. *Computers & Fluids* **68** (2012), 29–37. DOI: 10.1016/j.compfluid.2012.07.028.

[J20] L. Tamellini, L. Formaggia, E. Miglio, and A. Scotti. An Uzawa iterative scheme for the simulation of floating bodies. *Computers & Fluids* **68** (2012), 148–158. DOI: 10.1016/j.compfluid.2012.07.024.

[J21] F. Caliò and E. Miglio. Constrained reconstruction of 3D curves and surfaces using integral spline operators. *Communications in Applied and Industrial Mathematics* **4** (2013). DOI: 10.1685/journal.caim.461.

Papers in conference proceedings

[P1] F. Caliò, E. Miglio, G. Moroni, and M. Rasella. An improved B-spline approach for the surfaces reconstruction from data measured by CMM. In: *Proceedings of ASPE Summer Topical Meeting on Coordinate Measuring Machines*. Charlotte, North Carolina, USA. Charlotte, North Carolina, USA, June 2003, pp.26–32.

[P2] E. Miglio, S. Perotto, and F. Saleri. Multiphysics coupling strategy for free surface flows. In: *Proceedings of ADMOS2003*. Goteborg, 2003, pp.1–10.

[P3] E. Miglio and M. Rasella. An integral B-spline algorithm for curve and surface reconstruction. In: *Proceedings of the Eurographics Italian Chapter Conference*. September 25-26, Milano, 2003, pp.1–6.

[P4] Altinakar, M. Deville, C. Leupi, E. Miglio, and A. Quarteroni. A quasi 3D finite element shallow water flow with k-e turbulence model. In: *Proceedings of ICHE*. Brisbane - Australia, May 2004, pp.400–410.

[P5] F. Caliò, E. Miglio, G. Moroni, and M. Rasella. Surface reconstruction using $\lambda - \tau$ integral spline. In: *Proceedings of CIRP International Seminar on Intelligent Computation in Manufacturing Engineering*. Sorrento, Italy, June 2004, pp.675–678.

[P6] S. Perotto, E. Miglio, and F. Saleri. A coupling strategy for free surface flows. In: *Proccedings of ECCOMAS Conference, 4th European COngress on Computational Methods in Applied Sciences and Engineering*. Jyvaskyla, July 2004, pp.1–10. http://www.mit.jyu.fi/eccomas2004/proceedings/pdf/583.pdf.

[P7] V. Agoshkov, E. Miglio, and F. Saleri. Coupling of 2D and 1D Shallow Water Models by means of control theory. In: *Proceedings of ADMOS2005*. Barcelona, 2005, pp.191–194.

[P8] C. Leupi, E. Miglio, and M. Altinakar. Three-dimensional numerical modelling of curved open channel using non-hydrostatic turbulent finite element solver for free-surface flows. In: *Proceeding of the 3rd Int. M.I.T conference*. Boston, MA, 2005, pp.726–733.

[P9] E. Miglio and F. Saleri. Multiphysics methods in basin modeling. In: *Proceedings of ADMOS2005*. Barcelona, 2005, pp.281–290.

[P10] A. Mola, L. Formaggia, and E. Miglio. Simulation of the dynamics of an olympic rowing boat. In: *Proceedings of ECCOMAS CFD 2006*. Editors: P. Wesseling, E. Oñate, J. Pèriaux. Egmond aan Zee, The Netherlands, 2006, pp.1–10. http://proceedings.fyper.com/eccomascfd2006/documents/407.pdf.

[P11] E. Miglio and M. Rasella. A two steps fairing algorithm using lambda-spline. In: *Proceedings of the 40th CIRP International Seminar on Manufacturing Systems*. 30/05 - 01/06/2007, Liverpool (UK), 2007, pp.1–6.

[P12] E. Miglio, M. Altinakar, and G. Tayfur. Representation of linear terrain features in 2D free surface model using cut-cell boundary method. In: *Proceedings of River Flow 2008, International Conference on Fluvial Hydraulics*. Izmir, Turchia, 2008, pp.697–704.

[P13] M. Altinakar, M. McGrath, Y. Ozeren, and E. Miglio. Representation of linear terrain features in a 2D flood model with regular cartesian mesh. In: *Proceeding of the World Environmental and Water Resources Congress*. Kansas City, 2009, pp.1–10. DOI: 10.1061/41036(342)340. http://dx.medra.org/10.1061/41036(342)340.

[P14] M. Altinakar, M. McGrath, Y. Ozeren, and E. Miglio. Two-Sided Cut-Cell Boundary Method for Simulating Linear Terrain Features and 1D Stream Flows on a 2D Rectangular Mesh. In: *Proceedings of the 33rd International IAHR Biennial Congress*. Vancouver, Canada, 2009, pp.3959–3966.

[P15] E. Miglio, M. Altinakar, and M. McGrath. Representation of dam-breach geometry on a regular 2D mesh using quadtree local mesh refinement. In: *Proceedings of CMWR2010, XVIII International Conference on Water Resources*. Barcelona, Spain, June 2010, pp.1–10. http://congress.cimne.com/CMWR2010/Proceedings/docs/p84.pdf.

Book chapters

[BC1] E. Miglio, S. Perotto, and F. Saleri. "A multiphysics strategy for free surface flows". In: *Domain Decomposition Methods in Science and Engineering*. Springer Berlin Heidelberg, 2005, pp.395–402.

[BC2] L. Bonaventura, E. Miglio, and F. Saleri. "Finite Volume Solvers for the Shallow Water Equations Using Matrix Radial Basis Function Reconstruction". In: *Numerical Mathematics and Advanced Applications*. Springer Berlin Heidelberg, 2006, pp.207–214.

[BC3] E. Miglio and F. Saleri. "Geometric multiscale approach by optimal control for shallow water equations." In: *Applied and Industrial Mathematics in Italy II*. Hackensack, NJ – USA: World Scientific, 2007, pp.537–548.

[BC4] L. Formaggia, E. Miglio, A. Mola, and A. Scotti. "Numerical simulation of the dynamics of boats by a variational inequality approach". In: *Variational Analysis and Aerospace Engineering*. Springer New York, 2009, pp.213–227.

Teaching Experience

- Academic Year 2001/2002:

  1. Politecnico of Milan: "Numerical Methods for Design", Design Faculty, first year course, approx. 70 hrs and 200 students.
  2. Laboratory for the course of "Numerical Analysis" given by Prof. A. Veneziani at the Università degli Studi di Bergamo, Engineering Faculty, fourth year course, approx. 20 hrs and 50 students.

- Academic Year 2002/2003:

  1. Politecnico of Milan: "Numerical Methods for Design", Design Faculty, first year course, approx. 70 hrs and 200 students.
  2. Laboratory for the course of "Numerical Analysis" given by Prof. A. Quarteroni at Politecnico of Milano, Engineering Faculty, second year course, approx. 35 hrs and 60 students.

- Academic Year 2003/04:

  1. Politecnico of Milan: "Numerical Methods for Design", Design Faculty, first year course, approx. 70 hrs and 200 students.
  2. Laboratory for the course of "Numerical methods for PDE" given by Prof. F. Saleri at Politecnico of Milano, Engineering Faculty, fourth year course, approx. 20 hrs and 60 students.
  3. Laboratory for the course of "Numerical Analysis" given by Prof. A. Quarteroni at Politecnico of Milano, Engineering Faculty, second year course, approx. 35 hrs and 60 students.

- Academic Year 2004/05:

  1. Politecnico of Milan: "Numerical Methods for Design", Design Faculty, first year course, approx. 70 hrs and 200 students.
  2. Università degli Studi di Bergamo: "Numerical Analysis", Engineering Faculty, fourth year course, approx. 35 hrs and 50 students.

3. Università degli Studi di Bergamo: “Numerical methods for PDE”, Engineering Faculty, Phd Course, approx. 20 hrs and 10 students.

- Academic Year 2005/06:

1. Politecnico of Milan: “Numerical Methods for Design”, Design Faculty, first year course, approx. 70 hrs and 150 students.
2. Università degli Studi di Bergamo: “Numerical Analysis”, Engineering Faculty, fourth year course, approx. 35 hrs and 50 students.

- Academic Year 2006/07:

1. Politecnico of Milan: “Numerical Methods for Design”, Design Faculty, first year course, approx. 70 hrs and 150 students.
2. Università degli Studi di Bergamo: ‘Numerical methods for PDE”, Engineering Faculty, Phd Course, approx. 20 hrs and 10 students.
3. Lectures (4 hrs) on Environmental Fluid Dynamics in in the context of the course “Fluidodinamica Numerica: metodi di base, sviluppi recenti, applicazioni”, (Politecnico di Milano, Continuing Education Program).

- Academic Year 2007/08:

1. Introduction to FreeFEM++, Laboratories on Domain Decompostion Method and Introduction to Grid generation in the context of the course “Il Metodo degli Elementi Finiti: Fondamenti e Applicazioni Avanzate in Ingegneria” (4 hrs) (Politecnico di Milano, Continuing Education Program).
2. Politecnico of Milan: “Numerical Methods for Design”, Design Faculty, first year course, approx. 70 hrs and 150 students.
3. Introduction to Matlab and lecture on Basic Numerical Methods for Option Pricing using Matlab in the context of the master course ”Energy Finance & Commodity Trading”, MIP, Politecnico di Milano, 10 hrs.

- Academic Year 2008/09

1. Politecnico of Milan: “Numerical Methods for Design”, Design Faculty, first year course, approx. 70 hrs and 150 students.
2. Introduction to Matlab and lecture on Basic Numerical Methods for Option Pricing using Matlab in the context of the master course ”Energy Finance & Commodity Trading”, MIP, Politecnico di Milano, 10 hrs.

- Academic Year 2009/10

1. Politecnico of Milan: “Numerical Methods for Design”, Design Faculty, first year course, approx. 70 hrs and 150 students.
2. Introduction to Matlab and lecture on Basic Numerical Methods for Option Pricing using Matlab in the context of the master course ”Energy Finance & Commodity Trading”, MIP, Politecnico di Milano, 10 hrs.
3. Università di Bologna: ”Numerical methods for PDE”, Civil Engineering Faculty, fourth year course, approx. 30 hrs and 40 students.

- Academic Year 2010/11

1. Politecnico of Milan: “Numerical Methods for Design”, Design Faculty, first year course, approx. 70 hrs and 150 students.
2. Introduction to Matlab and lecture on Basic Numerical Methods for Option Pricing using Matlab in the context of the master course ”Energy Finance & Commodity Trading”, MIP, Politecnico di Milano, 10 hrs.
3. ”Introduction to CFD”, INdAM Intensive period on Analytical and Numerical Problems in Fluid Dynamics and Applications, Catania, 12 hrs.

- Academic Year 2011/12

1. Politecnico of Milan: “Numerical Methods for Design”, Design Faculty, first year course, approx. 70 hrs and 150 students.

2. Introduction to Matlab and lecture on Basic Numerical Methods for Option Pricing using Matlab in the context of the master course "Energy Finance & Commodity Trading", MIP, Politecnico di Milano, 10 hrs.
3. Politecnico di Milano: "Computer Animation", Design Faculty, third year course, approx 30 hrs and 50 students.

- Academic Year 2012/13

1. Politecnico of Milan: "Numerical Methods for Design", Design Faculty, first year course, approx. 70 hrs and 150 students.
2. Introduction to Matlab and lecture on Basic Numerical Methods for Option Pricing using Matlab in the context of the master course "Energy Finance & Commodity Trading", MIP, Politecnico di Milano, 10 hrs.
3. Politecnico di Milano: "Computer Animation", Design Faculty, third year course, approx 30 hrs and 50 students.
4. Politecnico di Milano: "Analytical and Numerical methods for PDE" (Numerical part), Mathematical Engineering, third year course, approx. 30 hrs and 60 students.
5. Politecnico di Milano: "Numerical Modelling of Geological Processes", PhD course, 10 hrs.

- Academic Year 2013/14

1. Politecnico of Milan: "Numerical Methods for Design", Design Faculty, first year course, approx. 70 hrs and 150 students.
2. Introduction to Matlab and lecture on Basic Numerical Methods for Option Pricing using Matlab in the context of the master course "Energy Finance & Commodity Trading", MIP, Politecnico di Milano, 10 hrs.
3. Politecnico di Milano: "Computer Animation", Design Faculty, third year course, approx 30 hrs and 50 students.
4. Politecnico di Milano: "Analytical and Numerical methods for PDE" (Numerical part), Mathematical Engineering, third year course, approx. 30 hrs and 60 students.

Invited talks in conferences and workshops

1. Grenoble, 8/2/2006, LMC-IMAG, "Multi-dimensional coupling strategies in hydrodynamic application" in the context of the workshop "Numerical Modeling for Floods"
2. Berlin, 7/7/2010, Freie Universitat Berlin, "Representation of Linear Terrain Features in a 2D Flood Model with Regular Cartesian Mesh using Ghost Fluid Method", in the context of the workshop "Cut Cell Method for Atmosphere and Ocean Modeling"
3. Milan, 1/12/2010, Politecnico, Dip. di Matematica, "Global Scale Plate Motions: From Geodynamics Towards Numerical Modeling" in the context of the workshop "Modelli Numerici per Equazioni Differenziali"
4. Messina, 17/2/2011, "Central schemes for hydrodynamic applications" in the context of the conference IPERME11
5. Minneapolis, 10/3/2011, IMA - University of Minnesota, "Numerical assesment of swimsuit performance" in the context of the workshop "Computing in Image Processing, Computer Graphics, Virtual Surgery, and Sports"
6. Trieste, 23/2/2012, SISSA, "Numerical modelling of competition rowing boats" in the context of the workshop "Free Surface Flows: Numerical Methodologies and Application to Naval Architecture".
7. Bilbao, 12/3/2013, BCAM, "Tectonic evolution at mid-ocean ridges: geodynamics and numerical modeling", in the context of the workshop "HPC-GA: High Performance Computing for Geophysics Applications"
8. Seville, 25/6/2013, Universidad Loyola Andalucia, "Tectonic evolution at mid-ocean ridges: geodynamics and numerical modeling", in the context of the conference NUMACH2013
9. Aachen, 23/9/2013, RWTH, "A family of variational time integrators for shallow water equations with source terms", in the context of the conference NUMHYP2013.

Invited talks

1. Messina, 6/2/2002, Accademia Peloritana dei Pericolanti, Mathematical and Numerical Modelling for Free Surface Flows
2. Messina, 7/2/2002, Accademia Peloritana dei Pericolanti, Coupling of fluid flow with porous media flow
3. Lausanne, 20/3/2002, EPFL, LHR, Some multiscale and multiphysics issues in hydrodynamics
4. Grenoble, 19/5/2005, LMC-IMAG, Multiscale methods in hydrodynamics
5. 5. Oxford, MS, USA, 21/9/2007, University of Mississippi, NCCHE, Hyperbolic Systems for MobileBed, FreeSurface Flow Modelling in Arbitrary Cross Sections
6. Brescia, 17/7/2008, Seminario Matematico di Brescia, Università Cattolica, Dip. di Matematica e Fisica, Representation of linear terrain features using a ghost fluid method
7. Desenzano del Garda, 25/08/2008, Modeling and Simulation of Hydrogeological phenomena
8. Catania, 24/2/2009, Scuola Superiore di Catania, Numerical methods for flood simulations
9. Torino, 3/3/2009, Dip. di Matematica, Finite Volume-Ghost Fluid Method for flood simulation
10. Oxford, MS, USA, 19/8/2009, University of Mississippi, NCCHE, Asymptotic Derivation of the Section-Averaged Shallow Water Equations for Natural River Hydraulics
11. Bologna, 11/5/2010, CIRAM, Università di Bologna, Kernel-based vector field reconstruction in computational fluid dynamic models
12. Oxford, MS, USA, 17/3/2011, University of Mississippi, NCCHE, Tectonic Evolution at Mid-Ocean Ridges: Geodynamics and Numerical Modeling
13. Chatou, France, 21/2/2012, EDF, Coupling Strategies in Hydrodynamics
14. Oxford, MS, USA, 14/6/2012, University of Mississippi, NCCHE, Mathematical and Numerical Models for the simulation of floating bodies and application to rowing boats
15. Seville, 22/2/2013, Seville University, Optimal transportation mesh-free method: a mesh-free method for fluid flows.
16. Bordeaux, 13/2/2013, INRIA Bordeaux, ”Galerkin Variational Integrators for Solid and Fluids Mechanics”.

Conference Presentations

1. “Numerical Modeling of Free Surface Hydrodynamics”, AMIF98, Applied Mathematics for Industrial Flow Problems, San Feliu de Guixols, Spain, October 1998,
2. “Finite Elements Approximation for Quasi-3D hydrodynamics equations”, 4th Workshop on Computational and Applied Methods for Oceanic, Atmospheric and Ground-water Flows, USGS Denver, Colorado (USA), September 1998:
3. “A Finite Element Scheme for Quasi-3D Shallow Water Equations”, SIMAI98, Giardini Naxos (Messina), Italy, June 1998:
4. “Coupling strategies in hydrodynamics: an a priori approach”, Convegno IPERPISA, Pisa, Italy, October 21 2004.
5. “Multidimensional coupling in hydrodynamics”, Adaptive modeling in hydrodynamics. ECMI 2004, the 13th European Conference on Mathematics for Industry, Eindhoven, June 25 2004.
6. “Adaptive modeling for unsteady nonlinear hydrodynamics: an application to a channel network”, WCNA 2004, Fourth World Congress of Nonlinear Analysts, Orlando, Florida, USA, July 2 2004.
7. “Coupling Strategies for Free-surface Flows”, ECCOMAS 2004, 4th European Congress on Computational Methods in Applied Sciences and Engineering, Jyväskylä, Finland, July 25 2004.
8. “Multiscale and multiphysics modelling in hydrodynamics”, Workshop MODECI, Rende (CS), March 31 2004.
9. “An a-priori approach for the coupling of hydrodynamics models”, GNCS Conference, Montecatini, February 10 2004.
10. “Multiphysics approach for free surface problems”, Convegno UMI, Milano, September 12 2003.

11. “An integral B-Spline algorithm for curve and surface reconstruction”, Eurographics Italian Chapter 2003, Milano, September 25-26 2003.
12. “Shape reconstruction and fairing using univariate and bivariate integral spline operators”, MeGAI 2006, Workshop on Geometrical Methods in Industrial Applications, Bologna, March 4 2006.
13. “Construction and Analysis of a Particular Bivariate Integral Spline Operator”, SIAM Conference on Geometric Design and Computing, November 2005, Phoenix, Arizona (USA).
14. “Representation of Linear Terrain Features in 2D Free Surface Models using Ghost Fluid Method ”, ECCOMAS 2008, July 2008, Venice, Italy.
15. “Representation of Linear Terrain Features in a 2D Flood Model with Regular Cartesian Mesh”, SIAM GS09, June 2009, Leipzig, Germany.
16. “Representation of Linear Terrain Features in a 2D Flood Model with Regular Cartesian Mesh”, Third FIMA Conference on Regional Protection and Management of Environmental Risks, January 2009, Gressoney-Saint-Jean, Italy.
17. “Representation of Dam-breach Geometry on a Regular 2-D Mesh using Quadtree local Mesh Refinement”, CMWR2010, June 2010, Barcelona, Spain.
18. “Representation of Linear Terrain Features in 2D Free Surface Models using Cut Cell Boundary Method”, RiverFlow 2008, September 2008, Izmir, Turkey.
19. “Integral tensor spline bases for free form surfaces”, Workshop “New Frontiers in CAGD”, May 2010, Bertinoro, Italy.
20. “Immersed Boundary Method for Flood Simulation”, SIAM GS11, March 2011, Long Beach, California, USA.
21. “Level Set Immersed Boundary Method For The Solution Of Shallow Water Flow”, CMWR2012, June 2012, Urbana-Champaign, USA.
22. “Ghost fluid method applied to the solution of Shallow Water Equations in complex domains”, Workshop “Numerical Aspects of Hyperbolic Balance Laws and Related Problems”, April 2012, Ferrara, Italy.
23. “Multidimensional Coupling for Shallow Water Flows”, SIAM GS 13, June 2013, Padova, Italy.
24. “Multidimensional Coupling for Shallow Water Flows”, ECMI 2014, June 2014, Taormina, Italy.
25. “Multiscale model of rift dynamics”, SIMAI2014, June 2014, Taormina, Italy.

Posters

1. Edie Miglio, Simona Perotto and Fausto Saleri “Multiphysics modeling for free-surface flows”, MODECI, Rende (CS), Italy, 2004.
2. Marco Cuffaro, Carlo Doglioni, and Edie Miglio “Tectonic Evolution at Rift Zones: Geodynamics and Numerical Modeling”, SIAM GS11, Long Beach, California, USA, 2011.
3. Miglio Edie and Mattia Penati, “Multigrid preconditioner for saddle point problems with highly variable coefficients”, PASC 2014, Zurich, Switzerland, 2014.

Organization of workshops and minisymposia

1. Workshop “Numerical modeling for scientific computing and advanced applications”, Dip. di Matematica, Politecnico di Milano, July 2nd 2004.
2. Minisymposium in collaboration with A. Veneziani, “Advances on Computational Hemodynamics” in ECMTB2002
3. Minisymposium in collaboration with T. Chacon-Rebollo, “Numerical Modelling of Hydrodynamic Geophysical Flows” in ECCOMAS2008
4. Minisymposium in collaboration with M. Altinakar, “Advances in Mathematical and Numerical Methods for Shallow Water Flows and Applications”, in SIAM GS 13
5. Minisymposium in collaboration with C. Doglioni, “Geodynamics Modeling: Mathematics, Numerics and HPC”, in SIAM GS13
6. Member of the Local Organizing Committee of SIAM GS13.

Service

1. Member of the scientific committee of SIMHYDRO Conferences (http://www.simhydro.org).
2. Member of the evaluation committee for an Assistant Professor Position in Numerical Analysis at University of Messina (2008).
3. Member of the evaluation committee for the Ph.D. thesis of C. Leupi at EPFL (2005).
4. Member of the evaluation committee for the Ph.D. thesis of M. Lombardi at EPFL (2012).
5. Member of the evaluation committee for the Ph.D. thesis of A. Agosti at University of Milan (2013).
6. Member of the evaluation committee for the Ph.D. thesis of M.L. Saetra at University of Oslo (2014).

Review activities

- Advances in Water Resources
- Computer and Fluids
- Water Resources Research
- Calcolo
- Journal of Computational Physics
- Tectonics
- International Journal of Environment and Pollution
- Communications in Applied and Industrial Mathematics
- Numerical Methods for Partial Differential Equations
- Mathematics and Computers in Simulation
- Journal of Petroleum and Gas Engineering
- Journal of Zhejiang University Science C (Computers & Electronics)
- Chemical Engineering Science
- SIAM Journal Scientific Computing
- ESAIM: Mathematical Modelling and Numerical Analysis
- Journal of Sediment Research
- Journal of Hydrologic Engineering
- Applied Mathematics and Computation

Ph.D. theses supervised

1. Advisor of the thesis ”Mathematical and numerical modeling in geodynamic applications”, by Penati M., Ph.D. in Mathematical Models and Methods in Engineering, Politecnico di Milano A.Y. 2013-14.

Master theses supervised

1. Co-advisor of the thesis ”Un modello Quasi-Idrostatico per la simulazione di correnti idrodinamiche” by L. Fontana, Aerospace Engineering Degree, Politecnico di Milano, A.Y. 1997-98, advisor Prof. A. Quarteroni.
2. Co-advisor of the thesis ”Accoppiamento numerico tra modelli 3D per fluidi a superficie libera e modelli per la filtrazione in mezzi porosi” by T. Ponta, Aerospace Engineering Degree, Politecnico di Milano, A.Y. 1998-99, advisor Prof. A. Quarteroni.
3. Co-advisor of the thesis ”Approssimazione numerica di modelli multistrato per fluidi a superficie libera” by E. Lazzaroni, Mathematics Degree, Università degli Studi di Milano, A.Y. 1999-2000, advisor Prof. F. Saleri.
4. Co-advisor of the thesis ”Approssimazione Numerica ed implementazione in ambiente object-oriented di un modello per la filtrazione in mezzi porosi” by L. Castelli, Mathematics Degree, Università degli Studi di Milano, A.Y. 1999-2000, advisor Prof. F. Saleri.

5. Co-advisor of the thesis "Comunicare la geometria" by C. Turri, Industrial Design Degree, Politecnico di Milano, A.Y. 2004-05, advisor Prof. N. Ceccarelli.
6. Co-advisor of the thesis "Tecniche di controllo per le equazioni delle acque poco profonde" by M. Calori, Aerospace Engineering Degree, Politecnico di Milano, A.Y. 2005-06, advisor Prof. F. Saleri.
7. Co-advisor of the thesis "Applicazioni della Differenziazione Automatica alla analisi di sensitivit delle soluzioni di problemi fluidodinamici" by F. Boschetto, Aerospace Engineering Degree, Politecnico di Milano, A.Y. 2006-07, advisor Prof. L. Formaggia.
8. Co-advisor of the thesis "Un approccio variazionale per il vincolo di galleggiamento applicato alla dinamica di imbarcazioni" by A. Paradiso, Aerospace Engineering Degree, Politecnico di Milano, A.Y. 2005-06, advisor Prof. L. Formaggia.
9. Co-advisor of the thesis "Modellizzazione matematica e numerica della dinamica di una imbarcazione da canottaggio" by L. DelGrosso, Aerospace Engineering Degree, Politecnico di Milano, A.Y. 2005-06, advisor Prof. L. Formaggia.
10. Co-advisor of the thesis "Modellistica mono e bidimensionale di reti di canali" by M. Mantovanelli, Aerospace Engineering Degree, Politecnico di Milano, A.Y. 2005-06, advisor Prof. A. Quarteroni.
11. Co-advisor of the thesis "Dinamica dei fluidi di secondo gradiente" by G. Giusteri, Physics Degree, Università Cattolica del Sacro Cuore di Brescia, A.Y. 2007-08, advisor Prof. A. Marzocchi.
12. Co-advisor of the thesis "Verification and Validation of the OpenFOAM library for external aerodynamics flows" by D. Bonetti, Aerospace ENgineering Degree, A.Y. 2007-08, advisor Prof. L. Formaggia.
13. Co-advisor of the thesis "Modellazione numerica della dinamica di imbarcazioni tramite vincolo unilatero sulla superficie libera" by M. Altieri, Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2008-09, advisor Prof. L. Formaggia.
14. Co-advisor of the thesis "Una metodologia di redesign in campo nautico basata sul reverse modeling" by A.B. Akpulat, Industrial Design Degree, Politecnico di Milano, A.Y. 2008-09, advisor Prof. G. Guidi.
15. Advisor of the thesis"Modellistica matematica e numerica per la verifica di ipotesi relative alla tettonica delle placche" by A. Stefanoni, Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2008-09.
16. Advisor of the thesis "Metodi a volumi niti centrati well balanced per la soluzione delle equazioni delle Shallow Water" by D. Ferrarese, Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2009-10.
17. Co-advisor of the thesis "Modellistica Fisico-Matematica e simulazioni numeriche dei processi di subduzione" by R. Penta, Physics Degree, Università Cattolica del Sacro Cuore di Brescia, A.Y. 2009-10, advisor Prof. A. Marzocchi.
18. Advisor of the thesis "Metodi Immersed Boundary ai volumi finiti centrali per il sistema delle acque basse" by S. Rinco, Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2010-11.
19. Co-advisor of the thesis "Sperimentazione e valutazione di OpenCL su piattaforme parallele per un metodo a volumi finiti per le acque basse" by R. Stramare, Computer Science Engineering Degree, Politecnico di Milano, A.Y. 2010-11, advisor Prof. L. Breveglieri.
20. Co-advisor of the thesis "Simulazione della dinamica di imbarcazioni da canottaggio usando geometrie reali e integrazione con la dinamica dei vogatori" by S. Palamara, Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2011-12, advisor Prof. L. Formaggia.
21. Advisor of the thesis "Multigrid preconditioning techniques for saddle point problems with highly variable coefficients" by F. Cattoglio, Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2013-14.
22. Advisor of the thesis "A mesh interpolation and upscaling algorithm for three dimensional basin modeling" by L. Pasquale, Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2013-14.

First Level theses supervised

1. Advisor of the thesis "Modello Numerico per la dinamica di corpi galleggianti applicato alle canoe da regata: accoppiamento del modello dinamico con un codice 3D a superficie libera" by D. Bonetti and L. Cartasegna, Aerospace Engineering Degree, Politecnico di Milano A.Y. 2004-05.
2. Advisor of the thesis "Formulazione ed implementazione di un metodo ad elementi discreti per la granulodinamica" by K. Sztekiel, Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2005-06.
3. Advisor of the thesis "Applicazione di modelli 1D e 3D in problemi di idrodinamica lacustre e fluviale" by D. Ferrarese and A. Denna Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2006-07.

4. Advisor of the thesis "Uso di Spline nella ricostruzione e fairing di curve e superfici" by D. Cagnoni, Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2008-09.
5. Advisor of the thesis "Individuazione di sorgenti inquinanti nei mezzi porosi mediante l'uso delle equazioni aggiunte" by F. Grossi and F. Cattoglio, Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2008-09.
6. Advisor of the thesis "Superfici minime: applicazioni in architettura" by A. Santucci, Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2009-10.
7. Co-advisor of the thesis "Equazioni paraboliche per lo studio della filtrazione in mezzi porosi" by L. Villani, Civil Engineering Degree, Politecnico di Milano, A.Y. 2010-11, advisor Prof. D. Lupo.
8. Advisor of the thesis "Algoritmi di Computer Vision nella ricostruzione del moto di atleti: una applicazione al canottaggio" by G. Casati, Mathematical Engineering Degree, Politecnico di Milano, A.Y. 2010-11.

Industrial Projects

1. Co-PI (with Dr. Nicola Parolini) of the project with FISA (International Rowing Federation) "Evaluation of minimum depth for a rowing course". FISA was considering the possibility to change the regulation allowing a shallower rowing course. The aim of this project is to support FISA in this critical decision by supplying a rigorous analysis of the problem based on numerical simulations.
2. PI of the project with Re.Al. Service P.I.E. "Development of Decision Support System for the management of environmental emergencies". The aim of the project is to develop a DDS (Decision Support System) for the management of environmental emergencies: in this context statistical analysis of historical data are carried out and prediction algorithm are going to be developed. Moreover the DSS will include also simplified models for the simulation of advection-diffusion of pollutant into the ground.
3. PI of the project with GE-Nuovo Pignone: Computation of eigenfrequencies of blades of steam turbines. The aim of the project is the development of a parallel software for the computation of the eigenfrequencies of a cascade of blades starting from the geometry of the blades and of the cascade.
4. PI of the project with ENI E&P Division: Mathematical and Numerical model of post-glacial rebound". The Glacial-Isostatic-Adjustment phenomenon describes the processes that tend to restore an equilibrium state on the Earth surface when an ice-load is present. These processes are evident in many areas of the Earth surface and they have been studied for different purposes *e.g.* define the ice extension and the sea-level during various geological periods and for assessing the rheological properties of the Earth. The above mentioned phenomenon is very important in petroleum engineering. This project aims at the development of a prototype software for the simulation of the GIA.
5. PI of the project with ENI E&P Division: Mathematical and Numerical modeling of plate tectonics. The project aimed at the development of new mathematical and numerical models for the simulation of plate tectonics. The first mathematical model that has been developed is a based on the so-called fluid approximation in which the dynamics of the rocks over long time scale can be approximated using the Stokes system with temperature dependent viscosity (visco-plastic model); a new mixed formulation for the Stokes problem along with a suitable preconditioning technique have been developed in order to solve efficiently the problem at hand. A parallel code based on Deal.II library has been implemented. A multiscale model for the simulation of oceanic rift has also been developed. The second step of the project was related to the study of the continental margins in which the fluid approximation is no longer valid hence elastic effects have to be included. In this sense a new family of variational time integrators for the solution of the elasticity problem has been developed, analyzed and implemented into an Octave package; moreover a preliminary GPU implementation has been realized.
6. PI of the project with COMES: Development of optimization algorithm for the production of optical lenses. The project aimed at the development of efficient and optimized algorithm to design toric lenses. In this context a new prototype software has been developed; the algorithm has been implemented into NC (Numeric Control) machine to produce real lenses.
7. PI of the project with Filippi Lido Srl: Development of algorithm for motion capture and application to acquisition of motion of athletes". During the project computer vision algorithms have been used for developing a prototype software able to automatically capture the motion of some markers placed on the body of the athletes using simple videos as input.
8. Co-PI of the project with Filippi Boats: "Modeling of the dynamics of rowing boats". The project aim at the development of a complete model for the simulation of the dynamics of a rowing boat. In particular during the project a detailed dynamical system describing the dynamics of the rowers has been

developed. This model has been coupled to different CFD solver (commercial and in-house) for the simulation of the fluid-structure interaction between the boat and the water. The code has been extensively tested and verified using experimental data.

9. Collaboration to the project with Ametek-TaylorHobson: "Development of algorithms and software for cam profile analysis". In this project a tool for cam profiles analysis has been developed: the tool starting from a set of measured point reconstructs the cam profile and analyzes the error with respect to a nominal shape. More information (in italian) on the project can be found at this we address `http://sportellomatematico.it/wp-content/uploads/2013/02/9_MI_numero_uno_MEI_2008_web_hires_01.pdf`.
10. Collaboration to the the project with ENI E&P Division: "Mathematical and Numerical modeling of salt tectonics". Various types of oil traps have been found to be associated with salt domes in subsurface geology. In this project the diapiric rise of light salt layers through a denser overburden has been modeled assuming that, in a geological time scale, salt and rocks layers behave like Newtonian fluids. A Lagrangian approach has been adopted to track the interface between layers, within the framework of a finite element space discretization. An accurate description of large deformations due to salt movement has been achieved using a grid adaptation technique based on geometrical refinement.
11. Collaboration to the project with ENEL Hydraulic and Structural Division: "Development of a software for the simulation of 3D water flows". In this project the mathematical and numerical model developed in [J2] and [J1] has been implemented into a parallel code.

Awards

1. Prize Young Researchers 2006, Department of Mathematics, Politecnico di Milano

Research activities

Free surface flow

In [J2] and [J1] a new finite element method for the solution of the hydrostatic 3D Shallow water equations has been proposed. The method has been also ported to parallel architectures using MPI and the results of the parallelizzation along with some applications to real cases are reported in [J3]. In order to consider a wider range of applications the hydrostatic approximation has to be removed: in [J7] a review of the mathematical models for free surface flow is reported along with a proposal for the development of a non hydrostatic free surface model. An efficient method for the solution of the non hydrostatic model is reported in [J4] where a suitable algebraic factorization procedure is introduced: essentially the idea is to generalize to the 3D non hydrostatic free surface equations the algebraic Chorin-Temam and the Yosida methods. The inclusion of a $k-\epsilon$ turbulence model has been considered in [J15], [P8] and [P4].

Multiscale and multiphysics modeling

In the context of hydraulics and hydrology there are many phenomena requiring a multiphysics or a multiscale approach to be properly described or solved. In particular the study has been focused on two issues: the surface and groundwater coupling and the multiscale modelling of free surface flow. It must be noticed that surface water and groundwater are not separate and independent and hence, in order to simulate real-world situations (such as the relation between a lake and an aquifer), a proper multiphysics model has to be developed. In this sense in [J5] and [J6] a coupling strategy between the 3D Shallow water (hydrostatic or not) and the Darcy equation has been proposed and analyzed. The multiscale modeling of free surface flow has been considered in [J9] and [J10]: in these papers a suitable set of boundary conditions and a coupling algorithm have been developed in order to couple 1D and 2D shallow water models; moreover in [J11] a goal-oriented adaptive method for dynamic coupling of 1D and 2D models has been studied. A further coupling strategy based on control theory has been proposed in [P7] and [BC3]. In [P12], [P13], [P14] and [P15] a novel approach based on the Immersed Boundary Method has been proposed for the representation of 1D features in 2D shallow water models: the method has been widely tested and it is implemented in the DSS-WISE model currently used by several federal and state agencies in USA (for more information about the project see this web address `http://www.ncche.olemiss.edu/sites/default/files/files/docs/dss-wise/DHS%20S%26T_Fact%20sheet_DSS-WISE_110425.pdf`). In [J13] a rigorous asymptotic analysis has been carried out to derive 1D averaged section model for open channel flow starting from the 3D free surface Navier-Stokes equations: this research is the first step for the development of a robust and mathematically sound coupling between 1D and 3D free surface model.

Dynamics of floating bodies

In [J12] a fluid structure algorithm has been developed to describe the dynamics of floating objects: in particular the algorithm has been applied to boat dynamics. The same idea has been exploited in [J20] and [BC4]: a new algorithm based on the Uzawa method and on the 3D Shallow water model developed in [J2] has been proposed for the simulation of general floating objects. In [J14] the previous mentioned fluid-structure algorithm has been coupled with a dynamical system for the simulation of the dynamics of rowing boats accounting for the motion of the rowers.

Interpolation and reconstruction methods

In [J17] and [BC2] a new method based on Radial Basis Function for the interpolation of vector fields has been introduced and studied. The method has been efficiently applied for the reconstruction of velocity vector field in the context of free surface Navier-Stokes code based on a Lagrange-Galerkin method. In [J16] and [J21] a particular family of integral splines has been introduced and used for the reconstruction of curves (in 2D and in 3D) and surfaces starting from a cloud of points; industrial applications of this method are reported in [P3], [P5] and [P11].

Computational geodynamics

In [J19] a 2D mathematical and numerical model for the simulation of oceanic rift is presented: the model is essentially a Stokes system with a non-Newtonian rheology where the viscosity is a complex nonlinear function of the temperature. Some 2D parallel (using MPI) numerical simulations for temperaturedependent mantle viscosity flow field beneath lithospheric plates that thicken with age have been carried out, evaluating tectonic evolution at mid-ocean ridges (MORs), useful to investigate the geometry of mantle upwelling and lithospheric thickness. The results have given new insights about the asymmetrical structures observed beneath MORs. This is an ongoing research in collaboration with the Department of Geology of Sapienza University in Rome and with Eni.

Languages

Language	Written	Spoken
Italian	mother tongue	mother tongue
English	Excellent	Fluent

Computer skills

Programming languages	Fortran, C++, Java, Python, CUDA
Operating systems	Windows, Unix, Linux
Scientific software	Matlab, Octave, Comsol, Fluent, Paraview
Scientific libraries	FEniCS, Deal.II, FreeFEM