CURRICULUM VITAE

Carlo LOVADINA

Current position: Full Professor of Numerical Analysis (SC: 01/MATH-05 - Analisi Numerica; SSD: MATH-05/A - Analisi Numerica) at the Department of Mathematics "F. Enriques" of the University of Milan (Università degli Studi di Milano), Italy

Education

1. November 1989– July 1993: Position at Collegio Ghislieri, Pavia.
2. March 1993: MSc in Mathematics, University of Pavia
3. February 1999: PhD in Mathematics, University of Milan

CURRICULUM VITAE ET STUDIORUM

1. 30.06.1995– 31.10.2000: Assistant professor in Mathematical Analysis at the Engineering School of the University of Trento.
2. 01.11.2000– November 2011: Associate professor in Numerical Analysis at the Department of Mathematics of the University of Pavia.
3. February 2002–: Research associate at IMATI of C.N.R., Pavia.
4. March 2004– June 2004: Visiting professor at the Institute of Mathematics, Helsinki University of Technology, invited by R. Stenberg.

5. April 2008: Visiting at the Department of Engineering Mathematics of the University of Concepcion, invited by R. Rodríguez.

6. July 2010: Habilitation as full professor in Numerical Analysis.

7. December 2011 - September 2016: Full professor of Numerical Analysis at the Department of Mathematics of the University of Pavia.

8. October 2016 –: Full professor of Numerical Analysis at the Department of Mathematics of the University of Milano.

Leading roles in projects

1. November 2002–October 2006: European project "Smart Systems: new materials, adaptive systems and their Nonlinearities. Modelling, Control and Numerical Simulation". Leader, with R. Stenberg, of the Work Package "Numerical Simulation". Scientific responsible of the following post-doc positions, financed by the project.

   - "Modelling and Numerical Simulation of Thin Structures". Duration: 3 months.
   - "Stabilized FEM for evolution problems involving Smart Materials". Duration: 12 months.
   - "FEM Analysis for Structural Mechanics". Duration: 2 months.
   - "Numerical treatment of circuit-device problems for Adaptive Systems". Duration: 3 months.
   - "Analysis and numerical simulation of rate-independent problems". Duration: 3 months.
   - "Numerical treatment of circuit-device problems for Adaptive Systems". Duration: 1 month.

2. September 2011 - August 2014 Unit leader of the European Project "Towards Enhanced Integration of Design and Production in the Factory of the Future through Isogeometric Technologies" (Small or medium-scale focused research project (STREP) proposal. Factories of the Future FP7-2011-NMP-ICT-FoF).

3. September 2019 – August 2023 Unit leader of the PRIN project "Virtual Element Methods: Analysis and Applications".

4. September 2021 – Unit leader of the PRIN project "Advanced polyhedral discretizations of heterogeneous PDEs for multiphysics problems".

Scientific activity

My scientific activity is mainly devoted to the numerical approximation of problems arising from Continuum Mechanics. In particular, I have considered the following topics.

- Finite Elements for Reissner-Mindlin plate problems.
- Finite Elements for piezoelectric plate problems.
- Finite Elements for laminated plate problems.
- Augmented-Lagrangean methods for problems in mixed form.
- Finite Elements for linear incompressible elasticity (and for the Stokes problem).
- Numerical approximation of finite Strain elasticity problems.
- Asymptotic behaviour of shell structures.
- *A posteriori* error estimates for elliptic problems in mixed form.
- Isogeometric Methods for Structural Mechanics problems.
- Virtual Element Methods: theoretical aspects and applications, with a particular reference to Continuum Mechanics problems.

Some other activities

1. December 2002– December 2008 : member of the "Commissione Informatica" del Dipartimento di Matematica dell'Università di Pavia.
2. October 2003– September 2008: member of the "Giunta del Dipartimento di Matematica", University of Pavia.
3. January 2017– : director of "Unità di Ricerca INdAM presso il Dipartimento di Matematica", University of Milan.
4. October 2016– September 2018: member and then president of the "Comitato di Garanzia per gli assegni di ricerca", University of Milan.
5. October 2017– January 2019: Department delegate for the "Assicurazione della Qualità della Ricerca", University of Milan.

6. February 2017– October 2018: president of the "Commissione Informatica del Dipartimento di Matematica", University of Milan.

7. October 2017– : member of the "Giunta del Dipartimento di Matematica", University of Milan.

8. October 2018– : head of Study Programme of the Academic Board for the Bachelor's and Master's Degree Programmes in Mathematic, University of Milan.

PUBLICATIONS

An updated list of publications is available on:

https://air.unimi.it/simple-search?query=lovadina

Journal papers

[1] C. Lovadina: "On the convergence of a mixed finite element method for Reissner-Mindlin plate", M^2AN, (28)5, 1994, 557–573.

[2] C. Lovadina: "A new class of mixed finite element methods for Reissner-Mindlin plates", *SIAM J. Numer. Anal.*, (33)6, 1996, 2457–2467.

[3] C. Lovadina: "Some rectangular finite element methods for Reissner-Mindlin plates", *Math. Models and Methods in Appl. Sci.*, (5)6, 1995, 777–787.

[4] C. Chinosi, C. Lovadina: "Numerical analysis of some mixed finite element methods for Reissner-Mindlin plates", *Comput. Mechanics*, 16(1), 1995, 36–44.

[5] D. Boffi, C. Lovadina: "Analysis of new augmented Lagrangian formulations for mixed finite element schemes", *Numer. Math.*, 75, 1997, 405–419.

[6] C. Lovadina: "Analysis of a mixed finite element method for Reissner-Mindlin plate problem", *Comput. Methods Appl. Mech. Engrg*, 163, 1998, 71–85.

[7] C. Lovadina: "Analysis of strain-pressure finite element methods for the Stokes problem", *Numer. Methods for PDE's*, 13, 1997, 717–730.

[8] A. Cazzani, C. Lovadina: "On some mixed finite element methods for plane membrane problems", *Comput. Mechanics*, 20, 1997, 560–572.

[9] C. Chinosi, C. Lovadina: "Remarks on partial selective reduced integration method for Reissner-Mindlin plate problem", *Computers and Structures*, 73, 1999, 73-78.

[10] F. Auricchio, C. Lovadina: "Partial selective reduced integration methods and kinematically linked interpolations for plate bending problems", *Math. Models and Methods in Appl. Sci.*, (9)5, 1999, 693–722.

[11] A. Blouza, F. Brezzi, C. Lovadina: "Sur la classification des coques linéairement élastiques", *C.R. Acad. Sci. Paris, Serie I, Tome 328, 1999*, 831–836.

[12] C. Baiocchi, C. Lovadina "Interpolation Theory and Shell Problems", *Appl. Math. Letters*, 7, 2000, 33–37.

[13] F. Auricchio, C. Lovadina: "Analysis of kinematic linked interpolation methods for Reissner-Mindlin plate problems", *Comput. Methods Appl. Mech. Engrg*, 190, 2001, 2465–2482.

[14] F. Auricchio, P. Bisegna, C. Lovadina: "Finite element approximation of piezoelectric plates", *Int. J. Numer. Methods Eng.*, 50, 2001, 1469–1499.

[15] F. Auricchio, C. Lovadina, E. Sacco: "Analysis of mixed finite elements for laminated composite plates", *Comput. Methods Appl. Mech. Engrg*, 190, 2001, 4767–4783.

[16] F. Auricchio, L. Beirão da Veiga, C. Lovadina: "Remarks on the asymptotic behaviour of Koiter shells", *Computers and Structures*, 80, 2002, 735–745.

[17] C. Baiocchi, C. Lovadina "A shell classification by Interpolation", *Math. Models and Methods in Appl. Sci.*, (12)10, 2002, 1359–1380.

[18] C. Lovadina, F. Auricchio: "On the Enhanced Strain Technique for Elasticity Problems", *Computers and Structures*, 81, 2003, 777–787.

[19] F. Auricchio, C. Lovadina, A.L. Madureira: "Asymptotically optimal models for heterogeneous linearly elastic plates", *ESAIM Mathematical Modelling and Numerical Analysis*, 38, 2004, 877–897.

[20] C. Lovadina: "A low-order nonconforming finite element for Reissner-Mindlin plates", *SIAM J. Numer. Anal.*, 42, 2005, 2688–2705.

[21] F. Auricchio, L. Beirão da Veiga, C. Lovadina, A. Reali: "A Stability Study of some Mixed Finite Elements for Large Deformation Elasticity Problems", *Comput. Methods Appl. Mech. Engrg.*, 194, 2005, 1075–1092.

[22] P. Hansbo, C. Lovadina, I. Perugia, G. Sangalli: "A Lagrange multiplier method for the finite element solution of elliptic interface problems using non-matching meshes", *Numerische Mathematik*, 100, 2005, 91–115.

[23] F. Auricchio, L. Beirão da Veiga, C. Lovadina, A. Reali: "An analysis of some mixed-enhanced finite element for plane linear elasticity", *Comput. Methods Appl. Mech. Engrg.*, 194, 2005, 2947–2968.

[24] C. Lovadina, R. Stenberg: "A posteriori error analysis of the linked interpolation technique for plate bending problems", *SIAM J. Numer. Anal.*, 43, 2005, 2227–2249.

[25] C. Chinosi, C. Lovadina, L.D. Marini: "Nonconforming locking-free finite elements for Reissner-Mindlin plates", *Comput. Methods Appl. Mech. Engrg.*, 195, 2006, 3448–3460.

[26] C. Lovadina, R. Stenberg: "Energy norm a posteriori error estimates for mixed finite element methods"", *Math. Comp.*, 75, 2006, 1659–1674.

[27] L. Beirão da Veiga, C. Lovadina, L.F. Pavarino: "Positive Definite Balancing Neumann-Neumann preconditioners for Nearly Incompressible Elasticity", *Numer. Mathematik*, 104, 2006, 271–296.

[28] L. Beirão da Veiga, C. Lovadina: "Asymptotics of Shell Eigenvalue Problems", *C.R. Acad. Sci. Paris, Ser. I*, 342, 2006, 707-710.

[29] F. Auricchio, L. Beirão da Veiga, A. Buffa, C. Lovadina, A. Reali, G. Sangalli: "A fully 'locking-free' isogeometric approach for plane linear elasticity problems: a stream function formulation", *Comput. Methods Appl. Mech. Engrg.*, 197, 2007, 160-172.

[30] L. Beirão da Veiga, C. Chinosi, C. Lovadina, R. Stenberg: "A-priori and a-posteriori error analysis for a family of Reissner-Mindlin plate elements", *BIT Numerical Mathematics*, 48, 2008, 189-213.

[31] E. Artioli, L. Beirão da Veiga, H. Hakula, C. Lovadina: "Free vibrations for some Koiter shells of revolution", *Appl. Math. Letters*, 21, 2008, 1245–1248.

[32] C. Lovadina, M. Lyly, R. Stenberg: "A posteriori estimates for the Stokes eigenvalue problem", *Numer. Methods for PDEs*, 25, 2009, 244-257.

[33] L. Beirão da Veiga, C. Lovadina: "An Interpolation Theory approach to shell eigenvalue problems", *Mathematical Models and Methods in Applied Sciences*, 18, 2008, 2003-2018.

[34] F. Auricchio, L. Beirão da Veiga, C. Lovadina, A. Reali: "The importance of the exact satisfaction of the incompressibility constraint in nonlinear elasticity: mixed FEMs versus NURBS-based approximations", *Comput. Methods Appl. Mech. Engrg.*, 199, 2010, 314-323.

[35] E. Artioli, L. Beirão da Veiga, H. Hakula, C. Lovadina: "On the asymptotic behaviour of shells of revolution in free vibration", *Comput. Mechanics*, 44, 2009, 45-60.

[36] L. Beirão da Veiga, C. Chinosi, C. Lovadina, L.F. Pavarino: "Robust BDDC preconditioners for Reissner-Mindlin plate bending problems and MITC elements", *SIAM J. Numer. Anal*, 47, 2010, 4214-4238.

[37] C. Lovadina, L.D. Marini: "A-Posteriori error estimates for discontinuous Galerkin approximations of second order elliptic problems", *Journal of Scientific Computing*, 40, 2009, 340-359.

[38] C. Lovadina, D. Mora, R. Rodríguez: "Approximation of the buckling problem for Reissner-Mindlin plates", *SIAM Numer. Anal.*, 48, 2010, 603-632.

[39] C. Lovadina, D. Mora, R. Rodrǵuez: "A locking-free finite element method for the buckling problem of a non-homogeneous Tmoshenko beam", *ESAIM Mathematical Modelling and Numerical Analysis*, 45, 2011, 603-626.

[40] F. Auricchio, G. Balduzzi, C. Lovadina; "A new modeling approach for planar beams: finite-element solutions based on mixed variational derivations, *Journal of Mechanics of Materials and Structures*, 5, 2010, 771-794.

[41] L. Beirão da Veiga, A. Buffa, C. Lovadina, M. Martinelli and G. Sangalli, "An isogeometric method for the Reissner-Mindlin plate bending problem", *Comput. Methods Appl. Mech. Engrg.*, 209, 2012, 45-53.

[42] L. Beirão da Veiga, C. Chinosi, C. Lovadina, L.F. Pavarino, "BDDC preconditioners for Naghdi shell problems and MITC9 elements", *Computers and Strucutres*, 102, 2012, 28-41.

[43] L. Beirão da Veiga, C. Lovadina, A. Reali, "Avoiding shear locking for the Timoshenko beam problem via Isogeometric collocation methods", *Comput. Methods Appl. Mech. Engrg.*, 241, 2012, 38-51.

[44] P.F. Antonietti, L. Beirão da Veiga, C. Lovadina, M. Verani, "Hierarchical a posteriori error estimators for the mimetic discretization of elliptic problems", *SIAM J. Numer. Anal.*, 51(1), 2013, 654-675.

[45] F. Auricchio, L. Beirão da Veiga, J. Kiendl, C. Lovadina, A. Reali, "Locking-free isogeometric collocation methods for spatial Timoshenko rods", *Comput. Methods Appl. Mech. Engrg.*, 263, 2013, 113-126.

[46] F. Auricchio, L. Beirão da Veiga, C. Lovadina, A. Reali, RL Taylor, P. Wriggers, "Approximation of incompressible large deformation elastic problems: some unresolved issues", *Comput. Mechanics*, 52, 2013, 1153-1167.

[47] F. Auricchio, G. Balduzzi, C. Lovadina, "The dimensional reduction modelling approach for 3D beams: differential equations and finite-element solutions based on Hellinger-Reissner principle", *Int. Journal of Solids and Structures*, 50, 2013, 4184-4196.

[48] L. Beirão da Veiga, C. Lovadina, D. Mora, Numerical results for mimetic discretization of Reissner-Mindlin plate problems, *Calcolo*, 50, 2013, 209-237.

[49] L. Beirão da Veiga, T.J. R. Hughes, J. Kiendl, C. Lovadina, J. Niiranen, A. Reali, H. Speleers. A locking-free model for Reissner-Mindlin plates: Analysis and isogeometric implementation via NURBS and triangular NURPS, *Mathematical Models and Methods in Applied Sciences*, 25, 2015, 1519-1551.

[50] F. Auricchio, G. Balduzzi, C. Lovadina. The Dimensional Reduction Approach for 2D Non-prismatic Beam Modelling: a Solution Based on Hellinger-Reissner Principle, *Int. Journal of Solids and Structures*, 63, 2015, 264-276.

[51] L. Beirão da Veiga, C. Lovadina, D. Mora. A Virtual Element Method for elastic and inelastic problems on polytope meshes, *Comput. Methods Appl. Mech. Engrg.*, 295, 2015, 327-346.

[52] L. Beirão da Veiga, C. Lovadina, G. Vacca. Divergence free Virtual Elements for the Stokes problem on polygonal meshes, *ESAIM Mathematical Modelling and Numerical Analysis*, 51, 2017, 509-535.

[53] E. Artioli, L. Beirão da Veiga, C. Lovadina, E. Sacco. Arbitrary order 2D virtual elements for polygonal meshes: part I, elastic problem, *Computational Mechanics*, 60, 2017, 355-377.

[54] E. Artioli, S. de Miranda, C. Lovadina, L. Patruno. A stress/displacement Virtual Element method for plane elasticity problems, *Comput. Methods Appl. Mech. Engrg.*, 325, 2017, 155-174.

[55] E. Artioli, L. Beirão da Veiga, C. Lovadina, E. Sacco. Arbitrary order 2D virtual elements for polygonal meshes: part II, inelastic problem, *Computational Mechanics*, 60, 2017, 643-657.

[56] L. Beirão da Veiga, C. Lovadina, A. Russo. Stability analysis for the virtual element method, *Mathematical Models and Methods in Applied Sciences*, 27, 2017, 2557-2594.

[57] L. Beirão da Veiga, C. Lovadina, G. Vacca. Virtual elements for the Navier-Stokes problem on polygonal meshes, *SIAM J. Numer. Anal.*, 56, 2018, 1210-1242.

[58] E. Artioli, S. de Miranda, C. Lovadina, L. Patruno. A family of virtual element methods for plane elasticity problems based on the Hellinger-Reissner principle, *Comput. Methods Appl. Mech. Engrg.*, 340, 2018, 978-999.

[59] E. Artioli, S. de Miranda, C. Lovadina, L. Patruno. An equilibrium-based stress recovery procedure for the VEM, *Int. Journal Numer. Methods Engrg.*, 117, 2019, 885-900.

[60] F. Dassi, C. Lovadina, M. Visinoni. A three-dimensional Hellinger–Reissner Virtual Element Method for linear elasticity problems, *Comput. Methods Appl. Mech. Engrg.*, 364, 2020, 112910.

[61] E. Artioli, S. de Miranda, C. Lovadina, L. Patruno. A dual hybrid virtual element method for plane elasticity problems, *ESAIM: Mathematical Modelling and Numerical Analysis*, 54, 2020, 1725-1750.

[62] A.M. D'Altri, S. de Miranda, L. Patruno, E. Artioli, C. Lovadina. Error estimation and mesh adaptivity for the virtual element method based on recovery by compatibility in patches, *Int. Journal Numer. Methods Engrg.*, 121, 2020, 4374-4405.

[63] C. Lovadina, D. Mora, I. Velasquez. A virtual element method for the von Karman equations, *ESAIM: Mathematical Modelling and Numerical Analysis*, 55, 2021, 533-560.

[64] L. Beirão da Veiga, F. Dassi, C. Lovadina, G. Vacca. SUPG-stabilized virtual elements for diffusion-convection problems: a robustness analysis, *ESAIM: Mathematical Modelling and Numerical Analysis*, 55, 2021, 2233-2258.

[65] F. Dassi, C. Lovadina, M. Visinoni. Hybridization of the virtual element method for linear elasticity problems, *Mathematical Models and Methods in Applied Sciences*, 31, 2021, 2979-3008.

Sections in books

[66] F. Auricchio, F. Brezzi, C. Lovadina: "Mixed Finite Element Methods", in *"Encyclopedia of Computational Mechanics", Wiley & Sons. Editors: E. Stein, R. de Borst, T.J.R. Hughes.*

[67] C. Lovadina: "A brief overview of plate finite element methods", in Integral Methods in Science and Engineering, Volume 2: Computational Aspects, Chapter 25, Birkhauser Boston. Editors: C. Constanda and M.E. Perez, 2010.

Some Congress Proceedings

[68] C. Chinosi, C. Lovadina: "Mixed finite elements for Reissner-Mindlin plate model", in *Advances in Finite Element Techniques, CIVIL-COMP, M. Papadrakakis and B.H.V. Topping Eds*, 1994, 33–38.

[69] A. Cazzani, C. Lovadina: "Finite elements for plane membrane problems with unsymmetric stresses", in *Joint Conference of Italian Group of Computational Mechanics and Ibero-Latin American Association of Computational Methods in Engineering*, 1996, 69–72.

[70] F. Auricchio, C. Lovadina: "Linking methods for Reissner-Mindlin plate problems", in *Atti del Congresso GIMC 98, Trento*, 1998, 13–16.

[71] F. Auricchio, C. Lovadina, E. Sacco: "Finite elements for laminated plates", in *Atti del Congresso GIMC2000, Brescia*, 2000.

[72] F. Auricchio, C. Lovadina, E. Sacco: "Finite element techniques for laminated composite plates", in *Proceedings of ECCOMAS 2000. CD-ROM.*

[73] C. Lovadina: "Energy estimates for linear elastic shells", in *Proceedings of the first MIT Conference on Computational Fluid and Solid Mechanics*, Vol. I, Elsevier, 2001, 330-331.

[74] C. Lovadina: "Energy estimates for shell problems", in Numerical Mathematics and Advanced Applications ENUMATH2001, Springer, 2003, 381-388.

[75] C. Lovadina, R. Nascimbene, I. Perugia, P. Venini: "Mixed methods for interface problems", in Proceedings of the second MIT Conference on Computational Fluid and Solid Mechanics, Vol. II, Elsevier, 2003, 2053-2056.

[76] F. Auricchio, L. Beirão da Veiga, C. Lovadina, A. Reali: "Enhanced Strain Methods for Elasticity Problems", in *Proceedings of ECCOMAS 2004. CD-ROM.*

[77] C. Chinosi, C. Lovadina, L.D. Marini: "Nonconforming finite elements for Reissner-Mindlin plates", in *Applied and Industrial Mathematics in Italy* (M. Primicerio, R. Spigler, and V. Valente Eds.), Series on Advances in Mathematics for Applied Sciences 69, 2005, 213–224, World Scientific.

[78] P. Hansbo, C. Lovadina, I. Perugia, G. Sangalli: "A Lagrange multiplier method for finite elements on non-matching meshes", in *Applied and Industrial Mathematics in Italy* (M. Primicerio, R. Spigler, and V. Valente Eds.), Series on Advances in Mathematics for Applied Sciences 69, 2005, 360–370, World Scientific.

Other works

[79] C. Lovadina, I. Perugia: "Finite element methods for piezoelectric Reissner-Mindlin plates", *Istituto Lombardo (Rend. Sc.)*, A129, 1995, 107–120.

[80] D. Boffi, C. Lovadina: "Remarks on augmented Lagrangian formulations for mixed finite element schemes", *Bollettino UMI*, 11–A, 1997, 41–55.

[81] A. Blouza, F. Brezzi, C. Lovadina: "A new classification for shell problems", *Pubblicazioni IAN–CNR n. 1128, Pavia, 1999.*

PhD thesis

[82] C. Lovadina: "Some finite element technique for plate bending problems", Tesi di Dottorato, Milano, 1999.

Teaching activity

Starting from 1995, I have taught several courses of Mathematical Analysis and Numerical Analysis at: the University of Trento, Pavia and Milano.

Theses supervised

- 2005/2006 – MSc Thesis in Civil Engineering at the University of Pavia: "Esperienze numeriche con il metodo degli elementi finiti per la trave di Timoshenko". Student: F. Marchetto.
- 2005/2006 – MSc Thesis in Mathematics at the University of Pavia: Titolo della tesi: "Studio della deformazione di un disco elastico incomprimibile: simulazione numerica ed identificazione dei parametri materiali". Student: L. Ferrari.
- 2006/2007. MSc Thesis in Civil Engineering at the University of Pavia: "Homogeneous and multilayered beam models: variational derivation, analytical and numerical solutions". Student: G. Balduzzi.

- 2007/2010. Co-supervisor with R. Rodríguez, of the PhD thesis: "Métodos de elementos finitos para problemas de estabilidad de estructuras delgadas". PhD student: D. Mora.
- 2010/2013. Co-supervisor with F. Auricchio, of the PhD thesis: "Beam Models: Variational Derivation, Analytical and Numerical Solutions". PhD student: G. Balduzzi.
- 2014/2015. MSc in Mathematics. Thesis: "Geometric integration of the point vortex equation on a rotating sphere". Student: M. Viviani.
- 2015/2016. MSc in Mathematics. Thesis: "Metodi di elementi virtuali per problemi in forma mista". Student: M. Visinoni.
- 2015/2016. MSc in Mathematics. Thesis: "Metodi di collocazione isogeometrica per problemi ellittici". Student: A. Libera.
- 2017/2018. (with M. Fuhrman) MSc in Mathematics. Thesis: "Numerical simulation of option pricing with stochastic volatility: the SABR model". Student: L. Bottelli.
- 2019/2020. MSc in Mathematics. Thesis: "Alcuni metodi di elelmenti virtuali a divergenza nulla per il problema di Stokes". Student: A. Tonini.
- 2020/2021. MSc in Mathematics. Thesis: "A non-standard Virtual element method for the Poisson's problem". Student: M.L. Trezzi.

Milano, August 2024

Carlo Lovadina