

Luca HELTAI

Curriculum Vitæ

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There are no answers – Only cross references.

Research Summary

I started my academic career with a bachelor and master degree in Electronic Engineering at the **University of Pavia**, where it quickly became clear that what really drew my attention were the *computational aspects* of the engineering problems I was studying.

A fortunate encounter with prof. Daniele Boffi, who would later become my PhD advisor, convinced me to focus on *computational mathematics*: I defended my master thesis under the supervision of prof. Giuseppe Savarè [2], and I applied for a PhD scholarship in “*Mathematics and Scientific Computing*”. At the time, I was the only person without a purely mathematical background among my fellow PhD colleagues.

I started cultivating a strong interest for *fluid-structure interaction problems* and *advanced computational techniques*, and my first works were all inspired by the “*Immersed Boundary Method*” [38, 37, 34, 33]. My most important contribution in this field [30] is the result of a **Fulbright scholarship** that allowed me to collaborate with the father of the Immersed Boundary Method, prof. Charles S. Peskin, at the **Courant Institute of Mathematical Sciences**, New York. Almost contemporary is my first (and so far only) single authored publication [31], and the beginning of my independence as a researcher [32].

A short postdoctoral period at ESM, the **Penn State Engineering Science and Mechanics Department**, at University Park, Pennsylvania, laid the foundations of a fruitful and ongoing collaboration with prof. Francesco Costanzo [28, 24, 35] on themes related to *brain biomechanics*. The following postdoctoral positions were all under the supervision of prof. Antonio DeSimone, the father of the applied mathematics laboratory **SISSA mathLab**, and culminated in a *associate professorship*. My role in the laboratory is to develop innovative methods and technologies [23, 26, 21] to tackle physiological, biological [29, 25, 36] and industrial FSI problems [26, 13]. The ongoing collaboration with the group of prof. Antonio DeSimone has given me several opportunities to apply my competence both in industrial environments and in biological fields, culminating in my most prestigious publication [27].

I constantly use and develop *open source* tools for *high performance computing*, and I am one of the main developers of the `deal.II` library (<http://www.dealii.org>) [15, 14]. I contributed in setting up the **Master in High Performance Computing** (<http://www.mhpc.it>) held jointly by SISSA and ICTP, and I am currently its director.

Current Positions

2018–Now **Associate Professor**, *SISSA - International School for Advanced Studies, mathLab Laboratory*, Trieste (Italy).
Numerical Analysis (MAT/08)

2014–Now **Director**, *Master in High Performance Computing*, SISSA – ICTP.

Awards

2005 – 2006 **Fulbright Scholarship**, *Courant Institute of Mathematical Sciences*, New York (United States).

Scientific Career

2012–2017 **Assistant Professor (Ricercatore)**, *SISSA - International School for Advanced Studies, mathLab Laboratory*, Trieste (Italy).
Numerical Analysis (MAT/08)

Postgraduate Positions

2007–2012 **Senior Postdoc**, *SISSA - International School for Advanced Studies*, Trieste (Italy).

Numerical Analysis, supervisor: Prof. Antonio DeSimone

2006–2007 **Postdoc**, *EMS - Penn State College of Earth and Mineral Sciences*, State College (United States of America).

Numerical Analysis, supervisor: Prof. Francesco Costanzo.

2005 – 2006 **Visiting Fulbright Scholar**, *Courant Institute of Mathematical Sciences*, New York, NY (United States of America).

Supervisor: Prof. Charles S. Peskin

2003–2007 **Ph.D.**, *Università degli Studi di Pavia*, Pavia (Italy).

Matematica e Calcolo Scientifico, supervisor: Prof. Daniele Boffi.

Visiting Positions

Gen–Feb 2010 **Visiting Young Researcher**, *Center de Mathématiques Appliquées, École Polytechnique*, Paris.

Contact: Prof. François Alouges

Nov–Dic 2009 **Visiting Young Researcher**, *Laboratori de Càlcul Numèric, Universitat Politècnica de Catalunya*, Barcelona.

Contact: Prof. Marino Arroyo

Nov–Dic 2008 **Visiting Young Researcher**, *Center de Mathématiques Appliquées, École Polytechnique*, Paris.

Contact: Prof. François Alouges

Under Graduate

Feb–Jub 2001 **Socrates-Erasmus Student**, *University of Strathclyde*, Glasgow (United Kingdom).

2003–2007 **Master**, *Università degli Studi di Pavia*, Pavia (Italy), 110/110 cum Laude.
Ingegneria Elettronica.

Teaching

Graduate Courses

- Fall, Yearly **Lecturer**, *Applied Mathematics: An introduction to numerical analysis and Scientific Computing*, SISSA - International School For Advanced Studies.
- Spring, Yearly **Lecturer**, *Numerical Solutions of PDEs using the Finite Element Method*, SISSA - International School For Advanced Studies.
- Spring, Yearly **Lecturer**, *Advanced Finite Element Analysis*, SISSA - International School For Advanced Studies.
- Mar 2016 **Lecturer & Coorganizer**, *Deal.II Users and Developers Training (smr 2909)*, ICTP - International Center for Theoretical Physics - Trieste.
- Feb 2009 **Lecturer & Coorganizer**, *The 2nd Workshop on High Performance Computing (HPC09)*, School of Physics - Teheran.
- Feb 2008 **Lecturer**, *Workshop on High Performance Computing (HPC08)*, School of Physics - Teheran.

Master Courses

- Fall, Yearly **Lecturer**, *Introduction to Numerical Analysis*, Master in Hight Performance Computing - SISSA - International School For Advanced Studies, ICTP - International Center for Theoretical Physics.
- Fall, Yearly **Lecturer**, *Comunicare la Matematica*, Master in comunicazione della Scienza - SISSA - International School For Advanced Studies.
- Academic Year 2012-2013 **Lecturer**, *Comunicare la Matematica*, Master in giornalismo scientifico e digitale - SISSA - International School For Advanced Studies.

Students and Postdocs

Former and Current Postdocs

- 2018 – **MHPC**, *Jacopo Rigosa*, Research Assistant, Assistant program coordinator for the Master in High Performance Computing, International School for Advanced Studies.
- 2015 – **MathLab, MHPC**, *Alberto Sartori*, Research Assistant, Assistant program coordinator for the Master in High Performance Computing, International School for Advanced Studies.
- 2015 – 2016 **MHPC**, *Nicola Cavallini*, Assistant program coordinator for the Master in High Performance Computing, International School for Advanced Studies and ICTP.
- 2014 – 2016 **MHPC**, *Giuseppe Piero Brandino*, Assistant program coordinator for the Master in High Performance Computing, International School for Advanced Studies and ICTP.
- 2015 – 2016 **MathLab**, *Mauro Bardelloni*, Research Assistant, International School for Advanced Studies.

Former and Current PhD Students

- Oct 2019 **Advisor**, *Ornela Mulita*, PhD Thesis, SISSA.
Expected date of graduation: October 2019
- Oct 2019 **Advisor**, *Giovanni Alzetta*, PhD Thesis, SISSA.
Expected date of graduation: October 2019
- Oct 2018 **Advisor**, *Giuseppe Pitton*, PhD Thesis, SISSA.
Expected date of graduation: October 2018
- Oct 2017 **Advisor**, *Nicola Giuliani*, PhD Thesis, SISSA.

Former and Current Master Students

- Dec 2016 **Advisor**, *Nicola Demo*, Master in HPC Thesis, SISSA-ICTP MHPC.
- Dec 2016 **Advisor**, *Giuseppe Puglisi*, Master in HPC Thesis, SISSA-ICTP MHPC.
- Dec 2016 **Advisor**, *Marco Raveri*, Master in HPC Thesis, SISSA-ICTP MHPC.
- Dec 2015 **Advisor**, *Nicola Giuliani*, Master in HPC Thesis, SISSA-ICTP MHPC.
Expected date of graduation: Dec 2015
- Dec 2015 **Advisor**, *Marco Tezzele*, Master in HPC Thesis, SISSA-ICTP MHPC.
Expected date of graduation: Dec 2015
- Dec 2015 **Advisor**, *Mauro Bardelloni*, Master in HPC Thesis, SISSA-ICTP MHPC.
Expected date of graduation: Dec 2015
- Oct 2015 **Advisor**, *Giovanni Alzetta*, Master Thesis, Università di Trieste.
Expected date of graduation: October 2015
- Oct 2015 **Advisor**, *Ornela Mulita*, Master Thesis, Università di Trieste.
Expected date of graduation: October 2015
- Oct 2014 **Advisor**, *Marco Tezzele*, Master Thesis, Università Statale di Milano.
- Apr 2014 **Advisor**, *Filippo Salmoiraghi*, Master Thesis, Politecnico di Milano.
- Apr 2012 **Advisor**, *Andrea Ottini*, Master Thesis, Università degli Studi di Pavia.
- Sep 2010 **Advisor**, *Marco Tezzele*, Bachelor Thesis, Università degli Studi di Pavia.

Projects

As Principal Investigator

- 2018 – **MDLab**, *Scuola Internazionale Superiore di Studi Avanzati*, “Application of Finite Element Methods in a simulator of nanoelectronic devices”, Principal Investigator.
- 2012 – 2013 **BrainIFEM**, *Scuola Internazionale Superiore di Studi Avanzati*, “Brain Biomechanics using the Finite Element Immersed Boundary Method: Application to Hydrocephalus”, Principal Investigator.
- 2012 – 2013 **SHARM**, *Scuola Internazionale Superiore di Studi Avanzati*, “Metodi di fluidodinamica computazionale per flussi con superficie libera”, Principal Investigator.

As Principal Investigator of a sub-section

- 2014 – **TRIM**, *Scuola Internazionale Superiore di Studi Avanzati*, “Progetto Mobilità Marina”, Research Member - PI of a sub-section.

- 2014 – **Open ViewSHIP**, *Scuola Internazionale Superiore di Studi Avanzati*, “Sviluppo di un ecosistema computazionale per la progettazione idrodinamica del sistema elica-carena”, Research Member - PI of a sub-section.
- 2010 – 2012 **OpenSHIP**, *Scuola Internazionale Superiore di Studi Avanzati*, “Simulazioni di fluidodinamica computazionale di alta qualità per le previsioni di prestazioni idrodinamiche del sistema carena – elica in ambiente open source”, Research Member - PI of a sub-section.
- As Research Member**
- 2014 – **PRIN & MIUR**, *Scuola Internazionale Superiore di Studi Avanzati*, “Modelli matematici e numerici del sistema cardiocircolatorio e loro applicazione in ambito clinico”, Research Member.
- 2007 – 2010 **Rinave**, *Scuola Internazionale Superiore di Studi Avanzati*, “Metodi innovativi nella simulazione numerica della interazione idrodinamica nave-mare”, Research Member.

Services to the Community

Institutional Responsibilities

- 2014 – **Director**, *Master in High Performance Computing*, SISSA – ICTP.
- 2017 – **Teaching Board**, *MsC in Data Science and Scientific Computing*, University of Trieste and Udine.
- 2014 – **Teaching Board**, *MsC in Mathematics*, University of Trieste.
- 2013 – **Member**, *High-Performance Computing Committee*, SISSA.
- 2013 – 2015 **Scientific and Teaching Board**, *Master in Science Communication “Franco Prattico”*, SISSA.
- 2013 – **Scientific and Teaching Board**, *Master in High Performance Computing*, SISSA – ICTP.
- 2012 – **Member**, *Information Technology Committee, Mathematics Area Representative*, SISSA.
- 2012 – **Scientific and Teaching Board**, *PhD in “Mathematical Analysis, Modeling, and Applications”*, SISSA.
- 2014 – **Member**, *Parithetic Commission*, SISSA - UNITS.

Organizing Committee

- Jul 2018 **Organizer**, *International School for Advanced Studies - Trieste*, “Sixth deal.II Users and Developers Workshop”, International Workshop on High Performance Computing.
24-26 Feb 2016
- Feb 2016 **Organizer**, *International School for Advanced Studies - Trieste*, “HPC - TS 2016”, International Workshop on High Performance Computing.
24-26 Feb 2016

- Mar 2016 **Organizer**, *International Center for Theoretical Physics - Trieste*, “Deal.II Users and Developers Training (smr 2909)”, Workshop.
21–24 Mar 2016
- Feb 2012 **Organizer**, *International School for Advanced Studies - Trieste*, “Free Surface Flows: Numerical Methodologies and Application to Naval Architecture”, Workshop.
23–24 Feb 2012
- May 2012 **Organizer**, *International School for Advanced Studies - Trieste*, “Mechanics of soft materials and tissues: modeling, simulation and experiments”, Workshop.
7–9 May 2012
- Dec 2011 **Organizer**, *International School for Advanced Studies - Trieste*, “State of the Art in CFD Techniques for Ship Hydrodynamics”, Workshop.
12–13 Dec 2011
- Feb 2009 **Coorganizer**, *School of Physics - Teheran*, “The 2nd Workshop on High Performance Computing”, Workshop.
- Spring 2007 **Organizer**, *Penn State University*, “Differential Equations, Continuum Mechanics and Numerical Methods: An Interdisciplinary Learning Seminar”, Seminar series.

Editorial Boards

MPE **Mathematical Problems in Engineering.**

Referee for International Journals

JFM **Journal of Fluid Mechanics.**

SINUM **SIAM Journal on Numerical Analysis.**

IMAJNA **IMA Journal of Numerical Analysis.**

EABE **Engineering Analysis with Boundary Elements.**

CAS **Computers & Structures.**

CAMWA **Computers & Mathematics with Applications.**

GCOM **International Journal of Computer Mathematics.**

IJCFD **International Journal of Computational Fluid Dynamics.**

Talks

Plenary Lectures

- 10 Oct 2017 **Advance in Mathematics for Technology 2017**, *University of Catania*, “*Unconventional frameworks for the numerical solution of fluid-structure interaction problems*”.
- 7 Jun 2013 **Perspectives on Fluid-Structure Interaction in the Nervous System.**, *Penn State University*, “*Efficient Simulations of Physiological Fluid Structure Interaction: the Variational Immersed Finite Element Method*”.
- 14 Jan 2013 **Software Frameworks for Challenging Computational Problems - SCICOMP 2013**, *Archimedes Center for Modeling, Analysis & Computation*, “*Unsteady and nonlinear ship-wave interactions with potential flow*”.

19 Sep 2012 **OCCAM Symposium on Brain Mechanics**, Oxford Center for Collaborative Applied Mathematics, “*An Overview of Immersed Finite Element Methods, with Focus on Brain Biomechanics*”.

July 2007 **Fourth M.I.T. Conference 2007**, Boston, USA, Coauthor of the article “*On the CFL condition for the finite element immersed boundary method.*”, Computers & Structures, 85(11-14):775—783, 2007, selected for presentation at a plenary session of the conference.

Invited Seminars

11 Apr 2017 Weierstrass Institute for Applied Analysis and Stochastics: “*A numerical framework for optimal locomotion at low Reynolds numbers*”, Seminar Materialmodellierung.

28 Mar 2017 Weierstrass Institute for Applied Analysis and Stochastics: “*Immersed Finite Element Methods for Interface and Fluid Structure Interaction Problems: an overview and some recent results*”, Seminar Numerische Mathematik.

21 Sep 2016 Weierstrass Institute for Applied Analysis and Stochastics: “*Problem Solving at Realistic Complexities using the deal.II library*”, Software and Mathematics colloquium.

3 May 2015 University of Roma 3: “*Problem Solving at Realistic Complexities: why high performance computing matters*”, Mathematics Colloquium.

16 Apr 2015 Weierstrass Institute for Applied Analysis and Stochastics: “*Coupling Isogeometric analysis and Reduced Basis Methods for Complex Geometrical Parametrizations - an Overview*”, “Numerical Analysis Seminars”, WIAS, Berlin.

05 Feb 2015 Politecnico di Milano: “*Exploiting Isogeometric Analysis in Fluid Structure Interaction Problems*”, Prin meeting “Cardiovascular Modelling”, MoX, Milano.

03 Feb 2015 Politecnico di Milano: “*An Overview of Isogeometric Boundary Element Method*”, MoX, Milano.

08 Oct 2014 University of Pavia: “*Isogeometric Boundary Element Method: overview and coupling with Reduced-Order Modelling techniques*”, Dipartimento di Ingegneria Civile e Architettura, Pavia.

07 Oct 2014 University of Pavia: “*Unsteady and Nonlinear Ship-Wave Interactions directly interfaced with CAD data structures*”, Seminari di Matematica Applicata (IMATI-CNR e Dipartimento di Matematica, Pavia).

20 Aug 2013 Texas A&M University : “*Combining BEM, ALE, DAE, FEM and SUPG in deal.II: unsteady and nonlinear ship-wave interactions.*”, Fourth deal.II Users’ and Developers’ Workshop.

7 Mar 2013 Interdisciplinary Center for Scientific Computing: “*Numerical simulations of FSI problems via Immersed Methods: a variational implementation.*”, IWR Seminars Series.

5 Dec 2012 International School for Advanced Studies: “*Nonsingular Isogeometric Boundary Element Method for Stokes Flows in 3D*”, SISSA mathLab Seminars.

- 8 May 2012 International School for Advanced Studies: “*An Overview of Immersed Finite Element Methods (with Possible Applications to Hydrocephalus)*”, Mechanics of soft materials and tissues: modeling, simulation and experiments.
- 24 Feb 2012 International School for Advanced Studies: “*A stable semi-Lagrangian potential method for the simulation of ship interaction with unsteady and nonlinear waves*”, Free Surface Flows: Numerical Methodologies and Application to Naval Architecture.
- 20 Oct 2011 Penn State University: “*A general framework for the study of Optimal Stokesian Swimmers*”, CAM Colloquium.
- 29 Sep 2011 Ravello: “*Optimally Swimming Stokesian Robots*”, XXXVI Summer School on Mathematical Physics.
- 14 Dec 2010 Università degli studi di Pavia: “*Stroke Optimization for Microswimmers using the Boundary Element Method*”, Seminari di Matematica Applicata, IMATI-CNR & DIMAT.
- 23 Sep 2010 International School for Advanced Studies - Trieste: “*Stroke Optimization for Microswimmers using the Boundary Element Method*”, SISSA - mathLab Seminar Series.
- 27 Nov 2009 Universitat Politècnica de Catalunya, Barcelona: “*Stroke Optimization for Microswimmers using the Boundary Element Method.*”, LaCàN Seminar Series.
- 13 Nov 2009 Universitat Politècnica de Catalunya, Barcelona: “*Fluid Structure Interaction made easy: the Finite Element Immersed Boundary Method*”, LaCàN Seminar Series.
- 5 Nov 2008 International Center of Theoretical Physics - Trieste: Seminar at the “*Advanced School in High Performance and GRID Computing*” on the principles of *Message Passing Interface* (MPI).
- 6 November 2008 International Center of Theoretical Physics - Trieste: seminar at the “*Advanced School in High Performance and GRID Computing*” on the use of parallel libraries for HPC in numerical analysis.
- 10 Apr 2007 University of Maryland: “*Distributional Body Force Densities in Finite Element Approximations of Continuum Mechanics Problems.*” Numerical Analysis Seminar.
- 18 Sep 2006 Penn State University: “*Stability Results and A-Priori Estimates for the Finite Element Immersed Boundary Method.*” Working Seminar on PDEs and their Applications.
- 7 Nov 2005 Penn State University: “*The Finite Element Immersed Boundary Method for Fluid Structure Interactions.*” PDE Numerical methods seminar.
- 18 Oct 2005 New York University: “*Numerical Stability of the (Finite Element) Immersed Boundary Method.*” Mostly Bio-mathematical Lunch Seminars.

Conferences

- 16 Sep 2016 **SIMAI 2016**, Milan, Italy, “*A natural framework for isogeometric fluid-structure-interaction: coupling BEM and Shell models*”.

- 16 Jun 2016 **MAFELAP 2016**, London, United Kingdom, “*A natural framework for iso-geometric fluid-structure-interaction: coupling BEM and Shell models*”.
- 15 Jun 2016 **MAFELAP 2016**, London, United Kingdom, “*A study on the accuracy of Immersed Finite Element Methods*”.
- 11 Aug 2015 **ICIAM 2015**, Beijing, China, “*A Natural Framework for isogeometric Fluid Structure Interaction: Coupling BEM and SHELL models*”.
- 10 Aug 2015 **ICIAM 2015**, Beijing, China, “*A strongly consistent and stable approximation strategy to couple compressible and purely elastic materials with incompressible viscous fluids in Immersed Boundary Methods and Immersed Finite Element Methods*”.
- 24 Jul 2014 **WCCM XI - ECCM V - ECFD VI**, Barcelona, Spain, “*Non singular iso-geometric boundary element methods for Stokes flows in 3D*”.
- 26 Jun 2012 **SIMAI 2012**, Torino, Italy, “*The Role of Membrane Viscosity in the Dynamics of Fluid Membranes*”.
- 14 Oct 2011 **SES 2011**, Chicago, USA, “*Bypassing the Explicit Approximation of the Dirac Delta Distribution in Immersed Finite Element Methods*”.
- 5 Oct 2010 **MMM 2010**, Freiburg, Germany, “*The Role of Membrane Viscosity in the Dynamics of Fluid Membranes*”.
- 30 Jun 2010 **USNCTAM 2010**, State College, USA, “*A Natural Modeling Tool for Soft Tissues: the Finite Element Immersed Boundary Method*”.
- 9 Jun 2009 **Coupled Problems 2009**, Ischia, Italy, “*Numerical Models for Axisymmetric Microswimmers*”.
- 1 Jul 2008 **IACM/ECCOMAS 2008**, Venice, Italy, “*Residual Based Formulations of Space-Time Discontinuous Galerkin Methods for Elasto-Dynamic Problems*”.
- 1 Jul 2008 **IACM/ECCOMAS 2008**, Venice, Italy, “*The Finite Element Immersed Boundary Method: Model, Stability, and Applications*”.
- 18 Jul 2006 **USNCCM 2007**, San Francisco, USA, “*The use of distributional body forces to enforce cracks in elastic materials*”.
- 25 Jun 2006 **SIMAI 2006**, Ragusa, Italy, “*Fluid-structure interaction via an adaptive finite element immersed boundary method*”.
- 18 Jul 2005 **ENUMATH 2005**, Santiago de Compostela, Spain, “*Stability results and algorithmic strategies for the finite element approach to the immersed boundary method*”.
- 14 Jun 2005 **Third M.I.T. Conference**, Boston, USA, “*Stability results for the finite element approach to the immersed boundary method*”.
- 3 Jun 2005 **EFEF 2005**, Third European Finite Element Fair, Pavia, Italy, “*Stability results for the finite element approach to the immersed boundary method*”.
- 22 Nov 2004 **INDAM 2004**, Bergamo, Italy, “*Approccio ad elementi finiti per il metodo del contorno immerso*”.
- 2004 **SIMAI 2004**, Venice, Italy, “*The immersed boundary method: a finite element approach*”.

Science Communication

- 16 Sep 2014 N3va, Sole 24 ore “*Il ruolo del software open source nell’accademia e nell’industria.*” Supercalcolo: scienza e applicazioni (web interview).
- 22 Jan 2014 **Organizer**, *International School for Advanced Studies - Trieste*, “Matematica & Vela”, Round table.
- 2014 – SISSA per la Scuola: “*Micronuotatori e numeri di Reynolds*” Short seminar for High School kids.
- 31 Jan 2013 Visit of European Union Commissions: “*SISSA mathLab Laboratory.*” Presentation of the laboratory (youtube video).
- 17 Jun 2010 Trieste: “*Professione? Personal Trainer per Micronuotatori: Un Viaggio nella Fluidodinamica Computazionale*”, ScienceAPE: Aperitivi Scientifici.
- 7 Oct 2008 Festival dei Saperi, Pavia: “*Numb3rs, Professione Matematico.*” Informative seminar for High School students.

Publications

Dissertations

- [1] **L. Heltai**. *The Finite Element Immersed Boundary Method*. PhD thesis, Università di Pavia, Dipartimento di Matematica “F. Casorati”, 2006.
- [2] **L. Heltai**. Implementazione di algoritmi di stima a posteriori per equazioni di evoluzione. Master’s thesis, Università di Pavia, Dipartimento di Ingegneria Elettronica, 2002.

Publications with peer review

- [3] G. Alzetta, D. Arndt, W. Bangerth, V. Boddu, B. Brands, D. Davydov, R. Gassm3ller, T. Heister, **L. Heltai**, K. Kormann, M. Kronbichler, M. Maier, J.-P. Pelteret, B. Turcksin, and D. Wells. The deal.ii library, version 9.0. *Journal of Numerical Mathematics*, 2018.
- [4] N. Giuliani, **L. Heltai**, and A. DeSimone. Predicting and optimizing microswimmer performance from the hydrodynamics of its components: The relevance of interactions. *Soft Robotics*, 2018.
- [5] N. Giuliani, A. Mola, and **L. Heltai**. π - BEM : A flexible parallel implementation for adaptive , geometry aware , and high order boundary element methods. *Advances in Engineering Software*, 121(March):39–58, 2018.
- [6] G. Pitton and **L. Heltai**. Accelerating the iterative solution of convection-diffusion problems using singular value decomposition. *Numerical Linear Algebra with Applications*, e2211, 2018.
- [7] G. Pitton and **L. Heltai**. Nurbs-sem: A hybrid spectral element method on nurbs maps for the solution of elliptic pdes on surfaces. *Computer Methods in Applied Mechanics and Engineering*, (338):440–462, 2018.
- [8] G. Puglisi, D. Poletti, G. Fabbian, C. Baccigalupi, **L. Heltai**, and R. Stom-

- por. Iterative map-making with two-level preconditioning for polarized cosmic microwave background data sets. *Astronomy & Astrophysics*, 618(A62), 2018.
- [9] S. Rafiei, B. Noroozi, **L. Heltai**, and A. Haghi. An authenticated theoretical modeling of electrified fluid jet in core-shell nanofibers production. *Journal of Industrial Textiles*, 47(7), 2018.
- [10] A. Sartori, N. Giuliani, M. Bardelloni, and **L. Heltai**. deal2lkit: A toolkit library for high performance programming in deal.II. *SoftwareX*, 7:318–327, 2018.
- [11] D. Arndt, W. Bangerth, D. Davydov, T. Heister, **L. Heltai**, M. Kronbichler, M. Maier, J.-P. Pelteret, B. Turcksin, and D. Wells. The deal.II library, version 8.5. *Journal of Numerical Mathematics*, 25(3):137–145, 2017.
- [12] **L. Heltai**, J. Kiendl, A. DeSimone, and A. Reali. A natural framework for isogeometric fluid-structure interaction based on bem-shell coupling. *Computer methods in applied mechanics and engineering*, 316:522–546, 04/2017 2017.
- [13] A. Mola, **L. Heltai**, and A. DeSimone. Wet and dry transom stern treatment for fully nonlinear potential flow simulations of naval hydrodynamics. *Journal of Ship Research*, 61(1):1–14, 2017.
- [14] W. Bangerth, D. Davydov, T. Heister, **L. Heltai**, G. Kanschat, M. Kronbichler, M. Maier, B. Turcksin, and D. Wells. The deal.ii library, version 8.4. *Journal of Numerical Mathematics*, 24(3):135–141, 2016.
- [15] W. Bangerth, T. Heister, **L. Heltai**, G. Kanschat, M. Kronbichler, M. Maier, and B. Turcksin. The deal.ii library, version 8.3. *Archive of Numerical Software*, 4(100):1–11, 2016.
- [16] M. Maier, M. Bardelloni, and **L. Heltai**. LinearOperator – a generic, high-level expression syntax for linear algebra. *Computers and Mathematics with Applications*, 72(1):1–24, 2016.
- [17] N. Rotundo, T.-Y. Kim, W. Jiang, **L. Heltai**, and E. Fried. Error analysis of a b-spline based finite-element method for modeling wind-driven ocean circulation. *Journal of Scientific Computing*, 69(1):430–459, 2016.
- [18] F. Salmoiraghi, F. Ballarin, **L. Heltai**, and G. Rozza. Isogeometric analysis-based reduced order modelling for incompressible linear viscous flows in parametrized shapes. *Advanced Modeling and Simulation in Engineering Sciences*, 3(1):21, 2016.
- [19] W. Bangerth, T. Heister, **L. Heltai**, G. Kanschat, M. Kronbichler, M. Maier, B. Turcksin, and T. D. Young. The deal.II library, version 8.2. *Archive of Numerical Software*, 3(100):1–8, 2015.
- [20] N. Giuliani, A. Mola, **L. Heltai**, and L. Formaggia. FEM SUPG stabilisation of mixed isoparametric BEMs: application to linearised free surface flows. *Engineering Analysis with Boundary Elements*, 59:8–22, 2015.

- [21] A. Manzoni, F. Salmoiraghi, and **L. Heltai**. Reduced Basis Isogeometric Methods (RB-IGA) for the real-time simulation of potential flows about parametrized NACA airfoils. *Computer Methods in Applied Mechanics and Engineering*, 284:1147–1180, 2015.
- [22] S. Roy, **L. Heltai**, and F. Costanzo. Benchmarking the immersed finite element method for fluid-structure interaction problems. *Computers and Mathematics with Applications*, 69:1167–1188, 2015.
- [23] **L. Heltai**, M. Arroyo, and A. DeSimone. Nonsingular isogeometric boundary element method for stokes flows in 3d. *Computer Methods in Applied Mechanics and Engineering*, 268:514–539, 2014.
- [24] **L. Heltai**, S. Roy, and F. Costanzo. A fully coupled immersed finite element method for fluid structure interaction via the deal.ii library. *Archive of Numerical Software*, 2(1):1–27, 2014.
- [25] F. Alouges, A. DeSimone, **L. Heltai**, A. Lefebvre, and B. Merlet. Optimally swimming stokesian robots. *Discrete and Continuous Dynamical Systems - Series B*, 18(5):1189–1215, 2013.
- [26] A. Mola, **L. Heltai**, and A. DeSimone. A stable and adaptive semi-lagrangian potential model for unsteady and nonlinear ship-wave interactions. *Engineering Analysis with Boundary Elements*, 37(1):128 – 143, 2013.
- [27] M. Arroyo, **L. Heltai**, D. Millán, and A. DeSimone. Reverse engineering the euglenoid movement. *Proceedings of the National Academy of Sciences of the United States of America*, 109(44):17874–17879, 2012.
- [28] **L. Heltai** and F. Costanzo. Variational implementation of immersed finite element methods. *Computer Methods in Applied Mechanics and Engineering*, 229–232(0):110 – 127, 2012.
- [29] F. Alouges, A. DeSimone, and **L. Heltai**. Numerical strategies for stroke optimization of axisymmetric microswimmers. *Mathematical Models and Methods in Applied Sciences*, 21(02):361–387, 2011.
- [30] D. Boffi, L. Gastaldi, **L. Heltai**, and C. S. Peskin. On the hyper-elastic formulation of the immersed boundary method. *Computer Methods in Applied Mechanics and Engineering*, 197(25-28):2210–2231, 2008.
- [31] **L. Heltai**. On the stability of the finite element immersed boundary method. *Computers & Structures*, 86(7-8):598–617, 2008.
- [32] P. F. Antonietti and **L. Heltai**. Numerical validation of a class of mixed discontinuous galerkin methods for darcy flow. *Computer Methods in Applied Mechanics and Engineering*, 196(45-48):4505–4520, 2007.
- [33] D. Boffi, L. Gastaldi, and **L. Heltai**. Numerical stability of the finite element immersed boundary method. *Mathematical Models and Methods in Applied Sciences*, 17(10):1479–1505, 2007.

- [34] D. Boffi, L. Gastaldi, and **L. Heltai**. On the CFL condition for the finite element immersed boundary method. *Computers & Structures*, 85(11-14):775–783, 2007.
- [Book chapters with peer review](#)
- [35] S. Roy, **L. Heltai**, C. Drapaca, and F. Costanzo. An immersed finite element method approach for brain biomechanics. In B. C. Prorok, F. Barthelat, C. S. Korach, K. J. Grande-Allen, E. Lipke, G. Lykofatitits, and P. Zavattieri, editors, *Mechanics of Biological Systems and Materials, Volume 5*, Conference Proceedings of the Society for Experimental Mechanics Series, pages 79–86. Springer New York, 2013.
- [36] A. DeSimone, **L. Heltai**, F. Alouges, and A. Lefebvre-Lepot. Computing optimal strokes for low reynolds number swimmers. In S. Childress, A. Hosoi, W. W. Schultz, and Z. J. Wang, editors, *Natural Locomotion in Fluids and on Surfaces*, volume 155 of *The IMA Volumes in Mathematics and its Applications*, pages 177–184. Springer New York, 2012.
- [37] D. Boffi, L. Gastaldi, and **L. Heltai**. The finite element immersed boundary method: model, stability, and numerical results. In S. Papadrakakis, Onate, editor, *Computational Methods for Coupled Problems in Science and Engineering*, pages 56–69, 2005.
- [38] D. Boffi, L. Gastaldi, and **L. Heltai**. A finite element approach to the immersed boundary method. In S. Saxe-Coburg Publications, Stirling, editor, *Progress in Engineering Computational Technology, B.H.V. Topping and C.A. Mota Soares Eds.*, pages 271–298, 2004.
- [Proceedings with peer review](#)
- [39] A. Mola, **L. Heltai**, and A. Desimone. Ship Sinkage and Trim Predictions Based on a CAD Interfaced Fully Nonlinear Potential Model. In *The 25th International Ocean and Polar Engineering Conference*, 2016.
- [40] A. Mola, **L. Heltai**, and A. Desimone. Nonlinear free surface potential flow simulations for hulls with a transom stern operating in dry and wet conditions. In *18th International Conference on Ships and Shipping Research*, 2015.
- [41] A. Mola, **L. Heltai**, and A. Desimone. A fully nonlinear potential model for ship hydrodynamics directly interfaced with CAD data structures. In *The 24th International Ocean and Polar Engineering Conference*, 2014.
- [42] A. Mola, **L. Heltai**, and A. Desimone. A stable semi-lagrangian potential method for the simulation of ship interaction with unsteady and nonlinear waves. In *17th International Conference on Ships and Shipping Research*, 2012.
- [43] D. Boffi, **L. Heltai**, L. Gastaldi, and C. S. Peskin. Fluid-structure interaction via an adaptive finite element immersed boundary method. *Communications to SIMAI Congress*, 1, 2007.
- [44] P. F. Antonietti, B. Ayuso, and **L. Heltai**. Schwarz domain decomposition preconditioners for interior penalty approximations of elliptic problems. In

A. Bermudez de Castro, D. Gomez, P. Quintela, and P. Salgado, editors, *Proceedings of ENUMATH 2005 the European Conference on Numerical Mathematics and Advanced Applications*, pages 423–431, 2006.

- [45] D. Boffi, L. Gastaldi, and **L. Heltai**. Stability results and algorithmic strategies for the finite element approach to the immersed boundary method. In A. Bermudez de Castro, D. Gomez, P. Quintela, and P. Salgado, editors, *Proceedings of ENUMATH 2005 the European Conference on Numerical Mathematics and Advanced Applications*, pages 557–566, 2006.
- [46] D. Boffi, L. Gastaldi, and **L. Heltai**. Stability results for the finite element approach to the immersed boundary method. In K. Bathe, editor, *Proceeding of the Third M.I.T. Conference on Computational Fluid and Solid Mechanics*, pages 93–96, 2005.

Submitted publications

- [47] **L. Heltai** and N. Rotundo. Error estimates in weighted sobolev norms for finite element immersed interface methods. Technical report, WIAS, 2016.
- [48] M. Tezzele, N. Cavallini, and **L. Heltai**. Algorithms, data structures and applications for isogeometric analysis with the deal.ii library. Technical Report 50/2015/MATE, SISSA, 2015.

Publications without peer review

- [49] **L. Heltai** and A. Mola. Towards the integration of cad and fem using opensource libraries: a collection of deal.ii manifold wrappers for the opencascade library. Technical report, SISSA, 2015.
- [50] W. Bangerth, T. Heister, **L. Heltai**, G. Kanschat, M. Kronbichler, M. Maier, B. Turksin, and T. D. Young. The deal.II library, version 8.1. 2014. <http://arxiv.org/abs/1312.2266>.
- [51] W. Bangerth, T. Heister, **L. Heltai**, G. Kanschat, M. Kronbichler, M. Maier, B. Turksin, and T. D. Young. The deal.II library, version 8.0. 2013. <http://arxiv.org/abs/1312.2266v3>.
- [52] M. Arroyo, A. DeSimone, and **L. Heltai**. The role of membrane viscosity in the dynamics of fluid membranes. Technical Report 55/2010/M, SISSA, 2010.
- [53] A. DeSimone, B. Bianchi, and **L. Heltai**. Stratos: a code for 3d free surface flows with floating constraints. Technical Report 41/2009/M, SISSA, 2009.
- [54] A. DeSimone, **L. Heltai**, and C. Manigrasso. Tools for the solution of pdes defined on curved manifolds with deal.ii. Technical Report 42/2009/M, SISSA, 2009.

Opensource software

- [55] **L. Heltai** and G. Alzetta. The deal.ii tutorial step-60: non-matching grid constraints through distributed lagrange multipliers, April 2018.
- [56] **L. Heltai** and A. Caiazzo. Immersed finite element elasticity method, 2018.

- [57] M. Maier, M. Bardelloni, and **L. Heltai**. Linearoperator benchmarks, version 1.0.0, March 2016.
- [58] A. Mola and **L. Heltai**. The deal.II tutorial step-54: using arbitrary CAD files to generate geometry-adapted triangulations, January 2015.
- [59] **L. Heltai**. The deal.II tutorial step-34: Boundary element methods (BEM) of low order to solve irrotational flows, March 2009.