Alejandro Cosimo

Curriculum Vitae

"I have never believed in geniuses, but I have in intense daily work" – René G. Favaloro

Personal data

- Birth: 19/08/1985 in Cañada de Gómez, Argentina
- Nationality: Argentinian/Italian
- Marital status: married. Children: one daughter
- City: Liège, Belgium
- ✉: alecosimo@gmail.com, ☎: +32484914984, skype: alecosimo

Professional experience

Current **Research Engineer** at the University of Liège. Since Oct 1, 2018.

Research Leave **Assistant Researcher** at the National Scientific and Technical Research Council (CONICET) of Argentina. Since Dec 1, 2016. Currently on research leave.

Research Leave **Teaching Assistant** at the Universidad Nacional del Litoral, Facultad de Ingeniería y Ciencias Hídricas. Since April 1, 2011. Currently on research leave.

2016 **Short research stay** at the International Center for Numerical Methods in Engineering, Technical University of Catalonia (UPC). July 2016.

2015-2016 **Postdoctoral Researcher** at the Institute of Applied Mechanics, Technische Universität München (TUM University Foundation Fellowship). From 01/05/2015 to 30/04/2016.

WiSe 2015/2016 **Ad-honorem Co-Lecturer** at the Institute of Applied Mechanics, Technische Universität München. Winter Semester (WiSe) 2015/2016.

2010-2015 Five years as **Doctoral Fellow** at the Centro de Investigación de Métodos Computacionales (CIMEC), Universidad Nacional del Litoral (UNL), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) and Autoridad Regulatoria Nuclear (ARN). `http://www.cimec.org.ar`. ARN fellow from 01/04/2010 to 31/03/2015. PhD. studies from 26/07/2010 to 17/11/2014.

Education

2014 **Universidad Nacional del Litoral (UNL)**, Santa Fe, Argentina. Facultad de Ingeniería y Ciencias Hídricas. From 26/07/2010 to 17/11/2014.

- *Doctor in Engineering - Field Computational Mechanics*, November 2014. GPA: 9.37 out of 10.

2009 **Universidad Nacional del Litoral (UNL)**, Santa Fe, Argentina. Facultad de Ingeniería y Ciencias Hídricas. From 01/03/2004 to 19/09/2009.

- Five-year professional degree in *Informatics Engineering*, September 2009. GPA: 9.03 out of 10.

2003 **Instituto Provincial de Educación Media (IPEM) Nº 59 "25 de Mayo"**, Cruz Alta, Córdoba, Argentina.

- Degree: *Bachiller y Técnico de Nivel Medio en Producción de Bienes y Servicios – Especialidad: Mantenimiento.*

  GPA of the Unified Basic Cycle (the first three years): 9.14 out of 10.

  GPA of the Specialisation Cycle (the second three years): 9.49 out of 10.

Current research interests

- Computational Mechanics. Trying to taste a little bit of everything.
- Nonsmooth Flexible Multibody Dynamics. Frictional contact with impacts. Lie group methods.
- Model Reduction Strategies.
- High Performance Computing. Domain Decomposition techniques, such as Finite Element Tearing and Interconnect (FETI) methods.
- The Finite Element Method (FEM).

Computational skills

- Developer of Odin: a multibody dynamics code based on the Lie group formalism
- I worked many years as developer on OOFELIE, a code for multiphysics problems
- I have experience developing PETSc extensions for FETI-based solvers
- Main programming languages: C/C++ and python
- Math libraries: PETSc, Eigen, Lapack and MKL
- HPC standards: MPI and OpenMP
- Robotic technology: Robot Operating System (ROS), Gazebo and MoveIt.
- Technical Computing Languages: Matlab
- Graphic APIs: I was using OpenGL and QT during my bachelor's final project ("Tools for Isogeometric Analysis").
- Simulation Pre and Post Processing. Pre-processing: mostly through python scripting. Post-processing: ParaView and python scripting.
- Operating Systems: Linux and Windows
- Typesetting: mostly LaTeX and Microsoft Office
- Source Code Management: git
- Build tool: cmake
- Web development (at a hobby-level): HTML, CSS, javascript and Node.js

PhD education

- Doctoral thesis defense: "Thermo-Mecano-Metallurgical modelling of welding. Application to welded joints in nuclear power plants" (Mark: 10 out of 10)

- Introduction to the Finite Element Method (Mark: 10 out of 10)
- Applied Mathematics (Mark: 10 out of 10)
- Fluid Mechanics (Mark: 8 out of 10)
- Solid Mechanics (Mark: 8 out of 10)
- High Performance Computing Applied to Continuum Mechanics. MPI, PETSc and Open-MP (Mark: 10 out of 10)
- Numerical Methods Applied to Transport Phenomena (Mark: 9 out of 10)
- Constitutive Models for Dissipative Materials: Application to Solid Mechanics (Mark: 10 out of 10)

Continued education / workshops

2019 Graphiz: the first Graphics-Physics Workshop, 24-25 Oct 2019, INRIA-Grenoble, Italy.

2019 2nd International Multibody Summer School, 20-24 May 2019, Parma, Italy.

2015 Workshop on Proposal Writing. Munich, Germany.

2012 RISC Summer/Winter School about High Performance Computing technologies. Buenos Aires, Argentina.

2011 Pan-American Advanced Studies Institute (PASI) Summer School: "Scientific Computing in the Americas: the challenge of massive parallelism".

Languages

Spanish **Mother tongue**

English **UNICert Level C1**

2015 DAAD English Certificate. Qualification: UNICert Level C1

2003 I took part in a Cultural Exchange in the St. Stithians Collage of English language, located in Johannesburg, South Africa. I attended classes during three months.

2002 English Certificate: Elementary Level (Pitman Qualifications; Qualification: First Class).

2001 English Second Year Level (Certificate of IATEL, Rosario).

Fellowships and scholarships

May 2015-April 2016 TUM University Foundation Fellowship to carry out research at Technische Universität München as a postdoc. From 01/05/2015 to 30/04/2016.

2010-2015 Five-years Doctoral Scholarship from the Nuclear Regulatory Authority, Argentina. Title: "Thermo-Mecano-Metallurgical modelling of welding. Application to welded joints in nuclear power plants". From 01/04/2010 to 31/03/2015.

2014 Scholarship to assist to the Research Opportunities Week at the Technische Universität München. 20-24 October, 2014.

2013 Scholarship to attend to the XX Congreso sobre Métodos Numéricos y sus Aplicaciones, ENIEF 2013, granted by the Programa para la Difusión de los Resultados de la Actividad Científico-Técnica (PRODACT) FICH-UNL. Resolution 180/13.

2012 Scholarship to attend to the RISC Summer/Winter School about High Performance Computing technologies.

2012 Scholarship from ABMEC (Brazilian Association for Computational Methods in Engineering) to assist to the 10th World Congress on Computational Mechanics.

2012 Scholarship to attend to the 10th World Congress on Computational Mechanics, granted by the Programa para la Difusión de los Resultados de la Actividad Científico-Técnica (PRODACT) FICH-UNL. Resolution 391/12.

2011 Pan-American Advanced Studies Institute (PASI) Summer School: National Science Foundation (NFS) assistance scholarship.

2008 Scientific scholarship, Universidad Nacional del Litoral. Title: "Tools for Isogeometric Analysis".

Awards and honors

2010 Recognition of Academic Achievement. Universidad Nacional del Litoral (granted by RedSport).

2010 Honor Diploma to one of the best averages of the Santa Fe Province in 2009. Awarded by revista Punto Biz, Fundación Banco Municipal de Rosario and SESA Select.

2010 Honor Diploma to the best average of 2009 in Informatics Engineering, Facultad de Ingeniería y Ciencias Hídricas, UNL. Granted by the Colegio de Ingenieros Especialistas, Santa Fe, Argentina.

2003 Medal to the highest average of the class (2003), Cooperativa Integral San José LTDA.

2003 Medal to the best student of the Specialisation Cycle, IPEM Nº 59.

2003 Medal to the highest average of the school in 2003, IPEM Nº 59.

Honor Roll Member of the IPEM Nº 59.

Teaching

2021 Robotix-Academy lecture module: "Theoretical and practical aspects of robotics simulation"

2016-2018 "Continuum Mechanics" (Undergraduate level).

2016-2018 "Introduction to the Finite Element Method" (Doctoral level).

WiSe 2015/2016 "Lab Structural Dynamics" (Master level).

2011-2013 "Theory of Computing", strictly speaking "Discrete Mathematics" (Undergraduate level)

2011 "Numerical Analysis" (Undergraduate level)

Experience in the evaluation of Master Theses

2016 Optimization of thermal energy storage systems for data centres, Marta Codina Gessé

2016 FSI procedures for Civil Engineering Applications, Rubén Zorrilla Martínez

2016 Optimization of mechanical contact in metal sheet stamping processes, Marc Puigpinós Blázquez

2016 Orthogonal Subgrid Scale stabilization for nonlinear reaction-convection-diffusion equations, Sanjay Komala Sheshachala

2016 Development of a computational tool for structural verification of dams, Lorenzo Gracia Llinares

2016 Sensitivity analysis and experimental calibration for the Additive Manufacturing computational framework, Tomás Varona Poncela

2016 Modelización numérica de la presa de Canelles, Samuel Canadell Ruiz

Experience leading students' projects

- *Bachelor's Final Project:* "Development of a library for the efficient handling of geometric operations in contact problems". Student: César Castillo.
- *Bachelor's Final Project:* "Parallelisation of a Finite Element Code targeting shared memory architectures". Student: Emmanuel Rojas Fredini.

Refereed archival Journals

2020 Alejandro Cosimo, Federico J. Cavalieri, Javier Galvez, Alberto Cardona, and Olivier Brüls. A general purpose formulation for nonsmooth dynamics with finite rotations: Application to the woodpecker toy. *Journal of Computational and Nonlinear Dynamics*, December 2020.

2020 Alejandro Cosimo, Federico J. Cavalieri, Alberto Cardona, and Olivier Brüls. On the adaptation of local impact laws for multiple impact problems. *Nonlinear Dynamics*, 102(4):1997–2016, November 2020.

2020 Javier Galvez, Federico J. Cavalieri, Alejandro Cosimo, Olivier Brüls, and Alberto Cardona. A nonsmooth frictional contact formulation for multibody system dynamics. *International Journal for Numerical Methods in Engineering*, May 2020.

2019 Alejandro Cosimo, Javier Galvez, Federico J. Cavalieri, Alberto Cardona, and Olivier Brüls. A robust nonsmooth generalized-α scheme for flexible systems with impacts. *Multibody System Dynamics*, 48(2):127–149, July 2019.

2018 Alejandro Cosimo, Alberto Cardona, and Sergio Idelsohn. Global-Local HROM for non-linear thermal problems with irreversible changes of material states. *Comptes Rendus Mécanique*, 346(7):539 – 555, 2018.

2017 Alejandro Cosimo, Alberto Cardona, and Sergio Idelsohn. Global-Local ROM for the solution of parabolic problems with highly concentrated moving sources. *Computer Methods in Applied Mechanics and Engineering*, 326(Supplement C):739 – 756, 2017.

2016 Alejandro Cosimo, Alberto Cardona, and Sergio Idelsohn. General treatment of essential boundary conditions in reduced order models for non-linear problems. *Advanced Modeling and Simulation in Engineering Sciences*, 3(1):1–14, 2016.

2014 Alejandro Cosimo, Alberto Cardona, and Sergio Idelsohn. Improving the k-compressibility of hyper reduced order models with moving sources: Applications to welding and phase change problems. *Computer Methods in Applied Mechanics and Engineering*, 274(0):237 – 263, 2014.

2013 Alejandro Cosimo, Víctor Fachinotti, and Alberto Cardona. An enrichment scheme for solidification problems. *Computational Mechanics*, 52(1):17–35, 2013.

2011 Lisandro D. Dalcin, Rodrigo R. Paz, Pablo A. Kler, and Alejandro Cosimo. Parallel distributed computing using python. *Advances in Water Resources*, 34(9):1124 – 1139, 2011.

Conferences, seminars and workshops

2021 Federico Cavalieri, Alejandro Cosimo, Eliana Sanchez, Olivier Brüls, and Alberto Cardona. Simulation of sliding friction of spherical rigid bodies subject to multiple impact collisions. In Martín Pucheta, Alberto Cardona, Sergio Preidikman, and Rogelio Hecker, editors, *Multibody Mechatronic Systems*. Springer International Publishingpages 151–158, 2021.

2021 Bruno A. Roccia, Alejandro Cosimo, Sergio Preidikman, and Olivier Brüls. Numerical models for the static analysis of cable structures used in airborne wind turbines. In Martín Pucheta, Alberto Cardona, Sergio Preidikman, and Rogelio Hecker, editors, *Multibody Mechatronic Systems*. Springer International Publishingpages 140–147, 2021.

2020 Alejandro Cosimo, Federico Cavalieri, Alberto Cardona, and Olivier Brüls. About the nonsmooth generalized-α; method and contact constraints at acceleration level. In *14th World Congress on Computational Mechanics (WCCM), ECCOMAS Congress 2020*, 2020.

2019 Javier Galvez, Alejandro Cosimo, Federico J. Cavalieri, Alberto Cardona, and Olivier Brüls. A general purpose formulation for nonsmooth dynamics including large rotations: Application to the woodpecker toy. In *Volume 6: 15th International Conference on Multibody Systems, Nonlinear Dynamics, and Control*. American Society of Mechanical Engineers, August 2019.

2019 Attendance to "Graphiz: the first Graphics-Physics Workshop", INRIA-Grenoble, France. 24-25 Oct 2019.

2019 Attendance to the "Eighth Symposium of the European Network for Nonsmooth Dynamics", INRIA-Grenoble, France. 17-18 Sept 2019.

2019 Alberto Cardona, Javier Galvez, Federico Cavalieri, Alejandro Cosimo, and Olivier Brüls. The nonsmooth generalized-α; method for flexible and rigid multibody system dynamics. In *ECCOMAS Multibody Dynamics Conference 2019*, 2019.

2019 Federico Cavalieri, Alejandro Cosimo, and Alberto Cardona. Modeling of Rolling and Sliding Friction of Spherical Rigid Bodies. In A. Cardona, L. Garelli, J. Gimenez, P. Kler, S. Damián, and M. Storti, editors, *Mecánica Computacional*, volume XXXVII, pages 1531–1531, 2019.

2019 Alejandro Cosimo, Federico Cavalieri, Alberto Cardona, and Olivier Brüls. Simulation of simultaneous multi-contact collisions in Non-Smooth Contact Dynamics. In *ECCOMAS Multibody Dynamics Conference 2019*, 2019.

2019 Javier Galvez, Federico Cavalieri, Alejandro Cosimo, Olivier Brüls, and Alberto Cardona. Non-smooth numerical solution of frictional contact problems in multibody systems. In *ECCOMAS Multibody Dynamics Conference 2019*, 2019.

2018 Alberto Cardona, Alejandro Cosimo, Federico Cavalieri, Olivier Brüls, Javier Galvez, and Vincent Acary. New Advancements in the Nonsmooth Generalized-α Time Integration Method. In *13th World Congress in Computational Mechanics (New York, US)*, 2018.

2018 Federico Cavalieri, Javier Galvez, Alejandro Cosimo, Alberto Cardona, and Olivier Brüls. A contact friction algorithm based on a Coulomb friction law to simulate three dimensional mechanisms. In José G. Etse, Bibiana M. Luccioni, Martín A. Pucheta, and Mario A. Storti, editors, *Mecánica Computacional*, volume XXXVI, pages 1647–1647, 2018.

2018 Alejandro Cosimo, Federico Cavalieri, Olivier Brüls, and Alberto Cardona. Simulation of simultaneous multi-contact collisions in non-smooth contact dynamics. In José G. Etse, Bibiana M. Luccioni, Martín A. Pucheta, and Mario A. Storti, editors, *Mecánica Computacional*, volume XXXVI, pages 1649–1649, 2018.

2017 Alejandro Cosimo, Alberto Cardona, and Sergio Idelsohn. A Global-Local scheme for problems with steep moving gradients well-suited for reduction strategies. In *1st ECCOMAS Thematic Conference on Simulation for Additive Manufacturing (Munich, Germany)*, 2017.

2017 Alejandro Cosimo, Alberto Cardona, and Sergio Idelsohn. Modelo de orden reducido Global-Local para problemas parabólicos con fuentes móviles concentradas. In Martín I. Idiart, Ana E. Scarabino, and Mario A. Storti, editors, *Mecánica Computacional*, volume XXXV, pages 2499–2499, 2017.

2017 Alejandro Cosimo, Alberto Cardona, and Sergio Idelsohn. ROM for the solution of parabolic problems with highly concentrated moving sources. In *III workshop CSMA-SEMNI on Numerical techniques for nowadays highly computationally demanding challenges: meshless, MOR and beyond*, 2017.

2017 Sergio Idelsohn, Alejandro Cosimo, and Alberto Cardona. A reduced order strategy for transient problems with high moving gradients. In *14th U.S. National Congress on Computational Mechanics (Montreal, Canada)*, 2017.

2016 Alejandro Cosimo, Alberto Cardona, and Rixen Daniel. About the parallel versatile implementation of finite element tearing and interconnect methods. In S. Giusti, M. Pucheta, and M. Storti, editors, *Mecánica Computacional*, volume XXXIV, pages 1235–1244, 2016.

2015 Alejandro Cosimo, Alberto Cardona, and Sergio Idelsohn. Essential boundary conditions and k-compressibility in hyper reduced order models. In *PANACM 2015 - 1st Pan-American Congress on Computational Mechanics, in conjunction with the 11th Argentine Congress on Computational Mechanics, MECOM 2015,* pages 1029–1040, 2015.

2014 Federico J. Cavalieri, Alejandro Cosimo, and Alberto Cardona. Estudio de desgaste en válvulas de motores de combustión interna mediante el método de los elementos finitos y ensayos experimentales. In G. Bertolino, M. Cantero, M. Storti, and F. Teruel, editors, *Mecánica Computacional*, volume XXXIII, pages 754–760, 2014.

2014 Alejandro Cosimo and Alberto Cardona. Aspectos de implementación informática para el modelado computacional de la evolución microestructural de materiales. In G. Bertolino, M. Cantero, M. Storti, and F. Teruel, editors, *Mecánica Computacional*, volume XXXIII, pages 3295–3312, 2014.

2014 Alejandro Cosimo, Alberto Cardona, Pablo Novara, and Nestor Calvo. Weld Residual Stresses modelling. Application to a nuclear power plant welded joint. In G. Bertolino, M. Cantero, M. Storti, and F. Teruel, editors, *Mecánica Computacional*, volume XXXIII, pages 3277–3294, 2014.

2013 Alejandro Cosimo, Alberto Cardona, and Sergio Idelsohn. Modelos de orden reducido para el problema térmico de soldadura. In C. García Garino, A. Mirasso, M. Storti, and M. Tornello, editors, *Mecánica Computacional*, volume XXXII, pages 3151–3163, 2013.

2012 Alejandro Cosimo and Alberto Cardona. Problemas de choque térmico en el método de los elementos finitos. In A. Cardona, P. H. Kohan, R.D. Quinteros, and M. Storti, editors, *Mecánica Computacional*, volume XXXI, pages 1937–1950, 2012.

2012 Alejandro Cosimo, Víctor Fachinotti, and Alberto Cardona. Temperature gradient discontinuity aware numerical scheme for solidification problems. In *Proceedings of the 10th World Congress on Computational Mechanics*, 2012.

2012 Emmanuel Rojas Fredini, Federico Benitez, Alejandro Cosimo, and Alberto Cardona. Paralelización de un código de elementos finitos en multiprocesadores de memoria compartida. In A. Cardona, P. H. Kohan, R.D. Quinteros, and M. Storti, editors, *Mecánica Computacional*, volume XXXI, pages 3153–3164, 2012.

2010 Víctor Fachinotti, Alberto Cardona, Alejandro Cosimo, Bernd Baufeld, and Omer Van der Biest. Evolution of temperature during shaped metal deposition: Finite element predictions vs. observations. In E. Dvorkin, M. Goldschmit, and M. Storti, editors, *Mecánica Computacional*, volume XXIX, pages 4915–4926, 2010.

2009 Alejandro Cosimo and Nestor Calvo. Operaciones de Manipulación de Objetos 3D. In C. García Bauza, P. Lotito, L. Parente, and M. Vénere, editors, *Mecánica Computacional*, volume XXVIII, pages 1203–1222, 2009.

2006 Attendance to the "Primer Congreso de Python en Santa Fe", UTN.

2004 Attendance to the conference "Galileo Galilei: entre mito y realidad", FIQ - UNL.

2003 Attendance to the X Latin American Convention of Astronomy and in the III Argentinian Planetarium Meeting. Carlos Paz, Córdoba.

2003 Attendance to the seminars of The Evolution of the Matter in the Cosmos. Carlos Paz, Córdoba.