

Sergio Zlotnik

Personal Information

Date of Birth 28 February, 1974
Place of Birth Buenos Aires, Argentina

Research Interests

My primary research interests lie in numerical methods and its application to solve dynamical geological and geophysical problems. This includes plate tectonics, self-consistent lithospheric and mantle dynamics and rock deformation. The multi-scale and multi-physics character of the behaviour of the Earth interior pose a real challenge for nowadays numerical tools.

Education

- 2008 **Ph.D. Geophysics**, *Universitat de Barcelona*, Barcelona, Spain.
- Dissertation Topic: “Numerical modelling of transient multiphase thermo–mechanical problems: Application to the oceanic lithosphere”
 - Advisors: Manel Fernández, Pedro Díez and Jaume Vergés
 - Awarded as best thesis of the Facultat de Geologia, Universitat de Barcelona, 2008.
 - Special mention by the Fundació J. García-Siñeriz for best PhD Thesis in Spain in Applied Geophysics, 2008-2009
 - Awarded as the second best numerical thesis, Spain 2008, by Sociedad Española de Métodos Numéricos en Ingeniería.
- 2002 **Licenciado Ciencias de la Computación (Computer Sciences)**, *Universidad de Buenos Aires*, Buenos Aires, Argentina.
- Final project: “Discrete Element Method applied to rock deformation processes”
 - Advisors: Ernersto Cristallini and Pablo Jacovkis
 - Degree accredited as equivalent to the corresponding Spanish degree “Ingeniero en Informática” by Ministerio de Educación y Ciencia, 2004.
- 2008 **Accreditation, Profesor Lector**, by *Agència per a Qualitat del Sistema Universitari de Catalunya*, Spain.
- 2012 **Accreditation, Profesor Agregado**, by *Agència per a Qualitat del Sistema Universitari de Catalunya*, Spain.

Academic Experience

2013–2014 **Academic Coordinator in the Sino-Spanish Campus at Tongji University**, Shanghai, China.

Sino-Spanish Campus (SSC) was co-founded by Tongji University, Polytechnical University of Madrid and Polytechnical University of Catalunya, with headquarters in Tongji. SSC has the mission of enhancing and deepening faculty and students mobility and research cooperation among Tongji and Spanish universities and organizations while, at the same time, promoting cultural communication between China and Spanish-speaking areas.

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- 2010–2013 **Coordinator of the Erasmus Mundus Master in Computational Mechanics**, *Universitat Politècnica de Catalunya*, Barcelona, Spain.
The Master is offered by a consortium of Universitat Politècnica de Catalunya (Barcelona), Swansea University (UK), Ecole Centrale Nantes (France), Stuttgart University (Germany), Tsinghua University (China) and the Centro Internacional de Métodos Numéricos en Ingeniería (CIMNE).
- 2010– **Lecturer (Profesor Lector)**, *Universitat Politècnica de Catalunya*, Barcelona, Spain.
LaCàN group at Applied Mathematics Department.
- 2008–2010 **Australian Research Council Research Fellow**, *Monash University*, Melbourne, Australia.
Group of Geodynamics, School of Geosciences/School of Mathematical Sciences.
- 2008 **Postdoc**, *Earth Sciences Institute Jaume Almera, CSIC*, Barcelona, Spain.
Group of Dynamics of the lithosphere.
- 2003–2008 **PhD student**, *Earth Sciences Institute Jaume Almera, CSIC*, Barcelona, Spain.
Group of Dynamics of the lithosphere.
- 2006–2008 **Associate Professor**, *Universitat Politècnica de Catalunya*, Barcelona, Spain.
LaCàN group at Applied Mathematics Department.
- 1997 - 2002 **Teaching Assistant**, *Universidad de Buenos Aires*, Buenos Aires Argentina.
Computer Sciences Department.
- 2002 - 2005 **Coordinator Teaching Assistant**, *Universidad de Buenos Aires*, Buenos Aires Argentina.
Computer Sciences Department.

Projects

- 2012–2014 **Desarrollo y análisis del método PGD para procesos de conformado termo-plástico**, *Ministerio de Ciencia e Innovación, DPI2011-27778-C02-02*, 122.000 €, PI: Antonio Huerta Cerezuela.
- 2010–2012 **The Initiation and 3D Evolution of Instabilities in the Deep Continental Lithosphere**, *Australian Research Council, DP1095166*, 370.000 au\$, PI: Louis Moresi.
- 2005–2008 **El sistema del Arco de Gibraltar: procesos geodinámicos activos de los márgenes sud-ibéricos**, *MCyT-DGI, CTM2005-08071-C03-03/MAR*, 72.590 €, PI: Manel Fernández.
- 2004–2007 **Imaging the Western Mediterranean Margins: A key target to understand the interaction between deep and shallow processes**, *Spanish, French, Dutch, German and Italian National Agencies under the European Science Foundation coordination, 01-LEC-EMA22F, ESF Eurocores-EUROMARGINS*, 1.200.000 €, PI: Manel Fernández.
- 2003–2007 **Estructura cortical y litosférica, movimientos verticales y dinámica sedimentaria en el margen septentrional del Mediterráneo Occidental**, *MCyT-DGI, REN2002-11230-E-MAR*, 140.000 €, PI: Manel Fernández.

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2000–2002 **Models for concurrent and distributed systems**, *Secretaría de Ciencia y Tecnología de la Universidad de Buenos Aires, EX-003*, PI: Roberto Jos^o Gabriel Bevilacqua.

Publications

- “Coupled mantle dripping and lateral dragging controlling the lithosphere structure of the NW-Moroccan margin and the Atlas Mountains: A numerical experiment” **S. Zlotnik**, M. Fernández, I. Jimenez. *Lithos*, Vol 189, 16-27, 2014, DOI: 10.1016/j.lithos.2013.10.016
- “A stable XFEM formulation for multi-phase problems enforcing the accuracy of the fluxes through Lagrange multipliers” P. Díez, Régis Cottreau and **S. Zlotnik**, *International Journal for Numerical Methods in Engineering*, Volume 96, Issue 5, Pages 269-338, 2013, DOI: 10.1002/nme.4554
- “Enforcing interface flux continuity in enhanced XFEM: stability analysis” P. Díez, **S. Zlotnik** and Régis Cottreau. *Mathematisches Forschungsinstitut Oberwolfach. Advanced Computational Engineering Organised by O. Allix, C. Carstensen, J. Schröder, Essen Peter Wriggers*, 2012
- “Subduction dynamics and the origin of Andean orogeny and Bolivian Orocline”. F. Capitanio, C. Faccena, **S. Zlotnik** and D. Stegman. *Nature*, Vol. 490, 83-86, 2011. doi:10.1038/nature10596
- “A proper generalized decomposition for the parametrized wave problem” D. Modesto, **S. Zlotnik**, A. Huerta. Full paper in proceedings of the V International Conference on Adaptive Modeling and Simulation, ADMOS, 2011.
- “Magma fracturing and healing: a mechanism for rhyolite magma degassing and origin of obsidian”. A. Cabrera, R. Weinberg, H. Wrigth, **S. Zlotnik**, R. Cas. *Geology*, Vol. 39, p. 67-70, 2011.
- “Controls on subduction reorganization in the Hellenic margin, eastern Mediterranean”. F. Capitanio, **S. Zlotnik** and C. Faccena. *Geophysical Research Letters*, 37, L14309, doi:10.1029/2010GL044054, 2010.
- “Assembling sparse matrices in Matlab”, **S. Zlotnik** and P. Díez. *International Journal for Numerical Methods in Biomedical Engineering*, Vol. 26, 760-769, 2010. *Communications in Numerical Methods in Engineering*, Published on line doi: 10.1002/cnm.1174, 2008.
- “The subductability of continental lithosphere: the before and after story” J.C. Afonso and **S. Zlotnik**. *Frontiers in Earth Sciences*, “Arc-Continent Collision”. D. Brown and P. Ryan Eds. ISBN: 978-3-540-88557-3. doi:10.1007/978-3-540-88558
- “Hierarchical X-FEM for n -phase flow ($n > 2$)”. **S. Zlotnik** and P. Díez. *Computer Methods in Applied Mechanics and Engineering*, Vol. 198, 2329–2338, 2009.
- “Modelling gravitational instabilities: slab break-off and Rayleigh–Taylor diapirism”. **S. Zlotnik**, M. Fernández, P. Díez and J. Vergés. *Pure and Applied Geophysics*, Vol. 165, 1-20, doi:10.1007/s00024-004-0386-9, 2008.
- “Small-scale gravitational instabilities under the oceans: Implications for the evolution of oceanic lithosphere and its expression in geophysical observables”. **S. Zlotnik**, J.C. Afonso, P. Díez and M. Fernández. *Philosophical Magazine*, Vol. 88, 28&29, 3197–3217, 2008.
- “The effects of compositional and rheological stratifications on small-scale convection under

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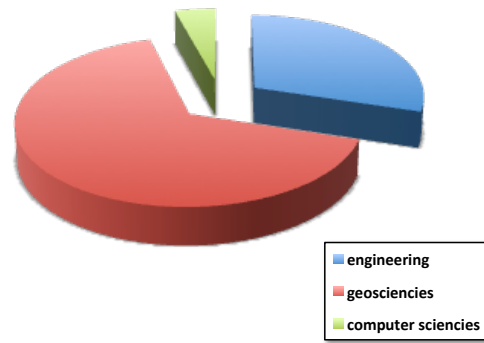
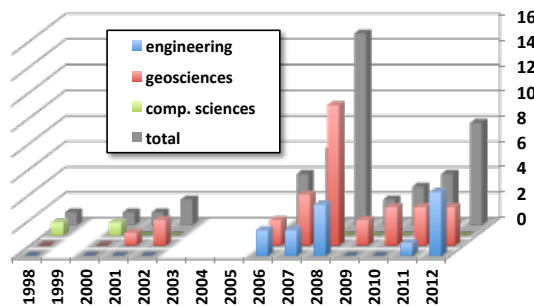
the oceans: implications for the thickness of the oceanic lithosphere and seafloor flattening". J.C. Afonso, **S. Zlotnik** and M. Fernández. *Geophysical Research Letters*. Vol. 35, L20308, doi:10.1029/2008GL035419, 2008.

- "Simulation of tectonic plates subduction with a multi-phase X-FEM model: level set representation, functional enrichment and numerical integration". P. Díez and **S. Zlotnik**. *International Journal of Material Forming*. Symposium MS16: ESAFORM-ECCOMAS Workshop, 2008
- "Numerical modelling of tectonic plates subduction using X-FEM". **S. Zlotnik**, P. Díez, M. Fernández and J. Vergés. *Computer Methods in Applied Mechanics and Engineering*, Vol. 196, 4283–4293, 2007.
- "Multiphase geophysical modeling of detachment process using level sets". **S. Zlotnik**, P. Díez, M. Fernández and J. Vergés. In: P. Díez and N.E. Wiberg (Ed.s), *Proc. International conference on Adaptive Modelling and Simulation (ADMOS)*, pages 331-334, 2005.

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Conferences



- “Reduced Order Models with (and for) goal-oriented error assessment” (Semi-Plenary Lecture) P. Díez, N. Parés, **S. Zlotnik**, F. Verdugo, A. Huerta. 11th World Congress on Computational Mechanics, Barcelona, Spain, July 2014.
- “Real time solution of parametrized thermal problems” (Keynote Lecture) **S. Zlotnik**, P. Díez and A. Huerta. 11th World Congress on Computational Mechanics, Barcelona, Spain, July 2014.
- “Real-time monitoring of harbor waves” A. Huerta, D. Modesto and **S. Zlotnik**. Computational Engineering and Science for Safety and Environmental Problems, Sendai, Japan, April 2014.
- “Modelling the Lithosphere-Asthenosphere System with Multi-Physics Finite Element Methods” B. Oliveira-Bravo, J.C. Afonso and **S. Zlotnik**. University of Western Australia, Lithosphere Dynamics Workshop, Perth, November 2013
- “Real time solution of PDE: reduce basis and the proper generalized decomposition” (Invited talk) **S. Zlotnik**. Mathematics and Geosciences Madrid, Spain, November 2013.
- “Coupled lithospheric mantle thickening in the NW-Moroccan margin and mantle thinning beneath the Atlas Mountains” M. Fernández, I. Jiménez-Munt, **S. Zlotnik**. 34th International Geological Congress, Brisbane Australia, 2012.
- “The Proper Generalized Decomposition applied to a parametrized wave propagation problem” D. Modesto, **S. Zlotnik**, A. Huerta. 10th World congress on Computational Mechanics, Sao Paulo, Brazil, 2012.
- “The Proper Generalized Decomposition applied to a practical wave propagation problem” D. Modesto, **S. Zlotnik**, A. Huerta. European Congress on Computational Methods in Applied Sciences and Engineering, Vienna, 2012
- “A stable XFEM formulation for multi-phase problems enforcing the accuracy of the fluxes” **S. Zlotnik**, P. Díez and R. Cottreau. European Congress on Computational Methods in Applied Sciences and Engineering, Vienna, 2012
- “Efficiency and accuracy of high-order computations and reduced order modelling in coastal engineering wave propagation problems” D. Modesto, **S. Zlotnik**, S. Fernández-Méndez and A. Huerta, Young Investigators Conference, Aveiro, Portugal, 2012.
- “Natural dam failure in the eastern slope of the central andes of Argentina. The Santa Cruz river outburst flood.” I.M. Penna, S. Daicz, **S. Zlotnik**, Marc-Henri Derron, M. Jaboyedoff. EGU General Assembly, Vienna, Austria, April 2012.
- “Combined underthrusting and mantle dripping - lateral dragging controlling the lithosphere structure of the NW-Moroccan margin and the Atlas Mountains” I. Jiménez-Munt, M. Fernandez and **S. Zlotnik**. EGU General Assembly, Vienna, Austria, April 2012.
- “Efficiency and accuracy of high-order computations and reduced order modelling in wave propagation problems”, D. Modesto, **S. Zlotnik**, S. Fernández-Méndez and A. Huerta. 11th Workshop on Numerical Methods in Applied Sciences and Engineering, Barcelona, 2012.
- “The subductability of the continental lithosphere in collisional settings: results from coupled thermodynamic-

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- thermomechanical numerical modelling”, J.C. Afonso and **S. Zlotnik**. AGU Fall meeting, Invited talk, San Francisco, USA, December 2011.
- “How bad XFEM behaves at estimating fluxes close to the interface and how to improve that behaviour”, R. Cottureau, P. Díez and **S. Zlotnik**, ADMOS conference, Paris, June 2011.
 - “A 3D multi-observable probabilistic inversion method for the compositional and thermal structure of the lithosphere and sublithospheric upper mantle”, J.C. Afonso, Y. Yang, J. Fullea, S. Lebedev and **S. Zlotnik**, EGU General Assembly, Vienna, Austria, April 2011.
 - “Imaging the lithosphere-asthenosphere boundary of southern Africa integrating elevation, surface heat flow, magnetotelluric and petrological data”, J. Fullea, M. Muller, A. Jones, J.C. Afonso and **S. Zlotnik**, EGU General Assembly, Vienna, Austria, April 2011
 - “Ultra-deep subduction of continental material: Results from coupled thermodynamic-thermomechanical numerical modelling” **S. Zlotnik** and J.C. Afonso. AGU Fall meeting, San Francisco, USA, December 2010.
 - “Tectonic evolution of the North Island of New Zealand” **S. Zlotnik**, L. Moresi, M. Faccenda, J.C. Afonso and T. Stern. Geomod meeting, Lisbon, Portugal, September 2010.
 - “The fate of subducted continental material: Results from coupled thermodynamic-thermomechanical numerical modelling” J.C. Afonso and **S. Zlotnik**. European Geosciences Union General Assembly 2010, Vienna, Austria, April 2010.
 - Convener of the Session “The Nature, Frequency, Size and Consequences of Instabilities of the Continental Lithosphere” on the AGU Fall meeting, San Francisco, USA, December 2009.
 - “The subductability of continental lithosphere” J.C. Afonso and **S. Zlotnik**. Arc-Continent Collision meeting, Galway, Ireland, May 2009.
 - “The effects of compositional and rheological stratifications on the evolution of oceanic lithosphere from geophysical-petrological-dynamic modelling” J.C. Afonso, **S. Zlotnik**, J. Fullea and M. Fernández. American Geosciences Union Fall Meeting, San Francisco, USA, December 2008.
 - “Characterizing the lithospheric-sublithospheric upper mantle system in 3D: its thermal, compositional, seismological and rheological structure” J. Fullea, J.C. Afonso, J.A.D. Connolly, M. Fernández, D. García-Castellanos and **S. Zlotnik**. American Geosciences Union Fall Meeting, San Francisco, USA, December 2008.
 - “New insights into the characterization of the crust and upper mantle from integrated modelling techniques” M. Fernández, J.C. Afonso, J. Fullea and **S. Zlotnik**. 4th International TOPO-EUROPE Workshop, Madrid, Spain, 2008.
 - “Evolution of the oceanic lithosphere: Small-scale convection and the rheology of the mantle”. **S. Zlotnik**, J.C. Afonso, M. Fernández, J. Fullea and P. Díez. GeoMod 2008, Florence, Italy, September 2008.
 - “LITMOD3D: A new 3D program for modelling the thermal, compositional, density, rheological and seismological structure of the lithosphere”. J. Fullea, J.C. Afonso, **S. Zlotnik** and M. Fernández. GeoMod 2008, Florence, Italy, September 2008.
 - “The influence of water in the rheological layering of the oceanic lithosphere and its relation with small-scale convection processes” **S. Zlotnik**, J.C. Afonso, M. Fernández and J. Fullea. ThermodynaMix II: Building a community data base of thermodynamic parameters for mantle minerals, Barcelona, September 2008.
 - “The lithospheric/sub-lithospheric upper mantle system: advances and limitations from recent multidisciplinary studies”. J.C. Afonso, M. Fernández, J. Fullea and **S. Zlotnik**. 33rd International Geological Congress, Oslo, Norway, August 2008.
 - “Hierarchical X-FEM for n -phase flow”. **S. Zlotnik**, P. Díez and M. Fernández. Workshop for Advancing Numerical Modelling of Mantle Convection and Lithospheric Dynamics. Davis, USA, July 2008.
 - “Hierarchical X-FEM”. P. Díez and **S. Zlotnik**. 8th World Congress on Computational Mechanics, Venice, Italy, June 2008.
 - “Evolution and stability of oceanic lithosphere: small-scale convection and the rheology of the sub-

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- lithospheric mantle". **S. Zlotnik**, J.C. Afonso, J. Fullea, M. Fernández and P. Díez. European Geosciences Union General Assembly 2008, Vienna, Austria, April 2008.
- "The nature of the lithospheric and sub-lithospheric upper mantle: recent views from interdisciplinary studies and their limitations" J.C. Afonso, M. Pérez-Gussinyé, J. Fullea and **S. Zlotnik**, M. Fernández. European Geosciences Union General Assembly 2008, Vienna, Austria, April 2008.
 - "LitMod3D: a new 3D program for modelling the thermal, compositional, density, rheological, and seismological structure of the lithosphere" J. Fullea, J.C. Afonso, J.A.D. Connolly, **S. Zlotnik** and M. Fernández. European Geosciences Union General Assembly 2008, Vienna, Austria, April 2008.
 - "Influence of upper plate structure and mantle viscosity on subduction geometry in South America: insights from numerical modelling". V.C. Manea, M. Pérez-Gussinyé, M. Manea, **S. Zlotnik** and M. Fernández. European Geosciences Union General Assembly 2008, Vienna, Austria, April 2008.
 - "A numerical study of the stability of the oceanic lithosphere". **S. Zlotnik**. 7th Workshop on Numerical Methods in Applied Science and Engineering, Vall de Nuria, Spain, January 2008.
 - "Hierarchical X-FEM applied to n -phase flow". **S. Zlotnik** and P. Díez. 7th Workshop on Numerical Methods in Applied Science and Engineering, Vall de Nuria, Spain, January 2008.
 - "Plate Tectonic subduction simulation using X-FEM". **S. Zlotnik**, P. Díez, M. Fernández and J. Vergés. Instabilities Across the Scales Symposium, Delft, The Netherlands, July 2007.
 - "A new code for dynamic subduction simulation". **S. Zlotnik**, M. Fernández, P. Díez and J. Vergés. Subduction zone geodynamics conference, Montpellier, France, Juny 2007.
 - "Multi-Phase Thermo-Mechanical Modeling of Plate Subduction Processes: the X-FEM Approach". P. Díez, **S. Zlotnik**, M. Fernández and J. Vergés. Coupled Problems, Ibiza, Spain, 2007.
 - "A numerical study of subduction parameters". **S. Zlotnik**, M. Fernández, P. Díez and J. Vergés. European Geosciences Union General Assembly 2007, Session GD07: Dynamics and Thermal Structure of Subduction Zones, Vienna, Austria, April 2007.
 - "Numerical Modelling of Tectonic Plate Subduction using X-FEM". **S. Zlotnik** and P. Díez. 6th Workshop on Numerical Methods in Applied Science and Engineering, Vall de Nuria, Spain, January 2007.
 - "Sparse matrix assembly". **S. Zlotnik**. 6th Workshop on Numerical Methods in Applied Science and Engineering, Vall de Nuria, Spain, January 2007.
 - "Thermo-mechanical numerical modelling of subduction processes". **S. Zlotnik**, M. Fernández, J. Vergés and P. Díez. Backbone of the Americas-Patagonia to Alaska, Geological Society of America, Mendoza, Argentina, April 2006.
 - "Numerical modelling of subduction processes". **S. Zlotnik**, M. Fernández, P. Díez and J. Vergés. European Geosciences Union General Assembly 2006, Session GD07: Dynamics and Thermal Structure of Subduction Zones, Vienna, Austria, April 2006.
 - "X-FEM applied to geophysical models". **S. Zlotnik** and P. Díez. 5th Workshop on Numerical Methods in Applied Science and Engineering, Vall de Nuria, Spain, January 2006.
 - "Slab Detachment Model". **S. Zlotnik** and P. Díez. 4th Workshop on Numerical Methods in Applied Science and Engineering, Vall de Nuria, Spain, January 2005.
 - "Simulación de pliegues con el Modelo de Elementos Discretos". **S. Zlotnik**, E. Cristallini P. Jacovkis and J. Calvo. XV Congreso Geológico Argentino, 2002.
 - "*Pull Apart* del Copahue. Estado tensional del arco volcánico a los 38 S". A. Folguera, D. Melnick, D. Yagupsky, D. Iaffa and **S. Zlotnik**. XV Congreso Geológico Argentino, 2002.
 - "Simulación de reservorios mediante el modelo de elementos discretos". **S. Zlotnik**, E. Cristallini and P. Jacovkis. Instituto Argentino de Gas y Petroleo, 2001.
 - "Alfa-1: A simulated computer with educational purposes". A. Tróccoli and **S. Zlotnik**. USENIX Annual Technical Conference, San Diego, USA, 2000.
 - "Using the DEVS paradigm to implement a Simulated Processor". S. Daicz, A. Tróccoli, **S. Zlotnik** and G. Wainer. In Proceedings of the 33rd Annual Symposium on Computer Simulation, Washington D.C.,

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USA, 1998.

Internal Reports

- “Architectural definition of the ALFA-1 simulated processor”. S. Daicz, A. Tróccoli, **S. Zlotnik** and G. Wainer. Internal report. Computer Science Dept., Univ. de Buenos Aires. <http://www.sce.carleton.ca/faculty/wainer/alfa-1.html>, 1998.

Professional Experience

- 1995–2003 **Programmer Analyst**, *Emprosoft Argentina S.A.*, Buenos Aires, Argentina.
Carried out several consulting projects, including development and support of call accounting software including reports, data processing, data storage, communication protocols, etc.

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