Juan E. Santos

Vita

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Education

Computador Científico	Universidad de Buenos Aires	1971
Licenciado en Matemática	Universidad de Buenos Aires	1974
Ph. D., Mathematics	University of Chicago	1983

PUBLICATIONS

BOOKS

1. J. E. Santos and P. M. Gauzellino, *Numerical Simulation in Applied Geophysics*, Birkhauser, Lecture Notes in Geosystems Mathematics and Computing, W. Freeden, Kaiserslautern, Z. Nashed, Orlando O. Scherzer (Eds), Vienna, ISBN 978-3-319-48456-3, ISBN 978-3-319-48457-0 (eBook) **DOI**: 10.1007/978-3-319-48457-0, 321 pages (2017).

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[2] J. Douglas, Jr., J. E. Santos, and J. L. Hensley, *Simulation of Biot waves in a cylindrically symmetric domain*, Third International Conference on Hyperbolic Problems; Theory, Numerical Methods and Applications (Björn Engquist and Bertil Gustafsson, eds.), Studentlitteratur, Chartwell-Bratt,, Uppsala, 1991, pp. 330–350.

[1] J. E. Santos, *Efficient time stepping methods for the simulation of wave propagation in three-dimensional elastic media*, Cuadernos de Matemática y Mecánica, N. 8, 1984, PEMA-INTEC, CONICET, Guemes 3450, 3000 Santa Fé.

Other works

[2] J. E. Santos, *Waves in Dispersive Media*, Technical Report #322, October 1998, Center for Applied Mathematics, Purdue University, Lecture Notes of a graduate course (MA692b), Purdue University, spring semester 1995 (86 pages).

[1] J. E. Santos, *Introduction to the Theory of Poroelasticity*, Technical Report #321, October 1998, Center for Applied Mathematics, Purdue University, Lecture Notes of a graduate course (MA692c), Purdue University, spring semester 1994 (100 pages).

Invited talks 2022

Numerical simulation of waves in non-isothermal poroelastic media, Rock Physics and Geofluid Detection Workshop, Hohai University, Nanjing, China, November 13, 2022.

Invited talks 2021

Wave induced fluid flow in gas-hydrate bearing sediments, Hohai University, Nanjing, China, December 20, 2021.

Invited talks 2020

Attenuation and dispersion of seismic waves in thin layered porous rocks saturated by two-phase fluids Society of Exploration Geophysics (SEG) Rock Physics Workshop, Hohai, China, December 18-20, 2020.

Invited Talks 2019

Invited Keynote Speaker: Seismic response of fractures and induced anisotropy in poroelastic media, Society of Exploration Geophysics (SEG) Rock Physics Workshop, Quindao, China, October 25-27, 2019.

Numerical Simulation of CO_2 Storage and Seismic Monitoring in Saline Aquifers, Beiging Chinese Geophysical Union Conference, Beiging, China, October 29, 2019.

Wuhan Applied Acoustic Conference, Numerical simulation of CO_2 sequestration, Wuhan, China, November 1rst, 2019.

Numerical Simulation in Applied Geophysics. From the Mesoscale to the Macroscale, Department of Geology, Northwest University, Xian, China, May 10th 2019,

Numerical Upscaling in Applied Geophysics. The Mesoscale, School of Earth Sciences and Engineering, Hohai University, Nanjing, China, May 15th, 2019.

Invited Talks 2018

A Finite Element Upscaling Procedure to Characterize Hydrocarbon Reservoir Formations, Rock Physics and Geofluid Detection Research Workshop, Hohai University, Nanjing, China, November 2-4, 2018,

Numerical Simulation in Applied Geophysics. From the Mesoscale to the Macroscale, 9th China National Symposium on Reservoir Acoustics and Drilling Exploration Technology Frontiers, Beijing, China, November 6th, 2018.

Invited Talks 2017

A Numerical Rocks Physics Approach to Model Wave Propagation in Hydrocarbon Reservoirs. III Workshop en Modelado, Migración e Inversión Sísmica, Universidad de Santander, Bucaramanga, Colombia. Junio 20-23, 2017.

Invited Talks 2016

Fracture Induced Anisotropy in Poroelastic Media A Finite Element Approach, Purdue University, Department of Mathematics, Bridge to Research, February 2, 2016.

Invited Talks 2015

Fractures and Induced Anisotropy in Poroelastic Media. From de Mesoscale to the Macroscale, IV International Conference on Applied Mathematics, Design and Control, Mathematical Methods and Modeling in Engineering and Life Sciences, November 4-6, 2015, Universidad Nacional de San Martín, Buenos Aires, Argentina.

Invited Talks 2014

Seismic response of fractures and induced anisotropy in poroelastic media, Department of Mathematics and Statistics, University of Calgary, Canada, October 2014.

Wave Propagation in Fractured Poroelastic Media, WCCM-ECCM-ECFD 2014 Congress, Minysimposium Advanced Computational Techniques in Geophysical Sciences I, July 23, 2014, Barcelona, Spain.

Numerical modeling of fluid flow and time-lapse seismics to monitor CO_2 sequestration in aquifiers, Instituto de Matemática Aplicada del Litoral (IMAL), May 30th, 2014, Santa Fe, Argentina,

Numerical Simulation of Fluid Flow and Time-Lapse Seismics Applied to CO_2 Sequestration at the Sleipner-field, GEOTECHNICAL WORKSHOP ON ENERGY GEOTECHNICS, PURDUE GEOTECHNICAL SOCIETY, April 26, 2014, Purdue Memorial Union.

Invited Talks 2013

Acoustics in porous media, Institute of Acoustics Orso Mario Corbino, Rome, Italy, July 19, 2013.

Invited Talks 2012

Harmonic experiments to model fracture induced anisotropy, KAUST-IAMCS WORKSHOP on Modeling and Simulation of Wave Propagation and Applications, Thuwal, Kindom of Saudi Arabia, May 8-9, 2012.

Invited Talks 2011

Numerical upscaling procedures in fluid-saturated poroelastic media Institute for Scientific Computation, Texas A& M University, September 2011.

Invited Talks 2008

Waves in Fluid Saturated Porous Media, Theory and Applications, Department of Civil Engineering, Purdue University, February 2008.

Waves in Porous Media and Applications, Conference of the Annual Meeting of the AR-SIAM, Santa Fé, Argentina, October 30th, 2008.

Invited Talks 2006

Wave propagation in Fluid Saturated Porous Media, Instituto de Matematica Aplicada del Litoral, Universidad Nacional del Litoral- CONICET, November 2006.

Invited Talks 2005

Hydraulic Conductivity Estimation in Partially Saturated Soils using the Adjoint Method, Congreso sobre Métodos Numéricos para Ecuaciones Diferenciales, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Buenos Aires, November 2005.

Invited Talks 2004

Approximation of Waves in Fluid–Saturated Porous Media. The Case of Composite Solid Frames, Institute for Scientific Computation, Texas A&M University, 3404 TAMU, College Station, Texas, USA, april 2004.

Invited Talks 2003

Numerical Simulation of Ultrasonic Waves in Reservoir Rocks with Patchy Saturation and Fractal Petrophysical Properties, Congreso INMAT 203, Facultad de Ingeniería, Universidad Nacional de Buenos Aires, december 15–18, 2003.

Invited Talks 2001

Numerical Simulation of Groundwater Flow in Variably Saturated Heterogeneous Soils, Instituto de Cálculo, Facultad de Ciencias Exactas y Naturales, Universidad Nacional de Buenos Aires, October 2001.

Invited Talks 1999

Nonconforming Methods for Maxwell Equations with Application to Magnetotellurics, Conference on the Mathematics of Finite Elements and Applications (MAFELAP99), Minisymposium on the Time Harmonic Maxwell Equations, Brunel University, London, june 24, 1999.

Invited Talks 1998

Nonconforming Mixed Finite Element Methods for Maxwell Equations, Laboratorio de Computaçao Científica del CNPq, Rua Getulio Vargas 333, Quitandinha, 25651-070, Petrópolis, RJ, Brasil, june 24, 1998.

Invited Talks 1997

Parallel algorithms for the numerical simulation of waves, Italian-Latinamerican Conference on Applied and Industrial Mathematics (ITLA '97), Rome, Italy, January 28, 1997.

Invited Talks 1996

Modelado numérico en geofísica aplicada, Escuela de Matemática Aplicada a la Industria, Facultad de Ingeniería, Universidad de Mar del Plata, August 9, 1996.
Numerical simulation of waves in dispersive media, School on Numerical Simulation of PDEs: Methods, Algorithms, Application, International Center for Theoretical Physics, Trieste, Italy, September 23, 1996.

Invited Talks 1995

Parallel algorithms for the simulation of waves; implementation in the Paragon XP/S Parallel Supercomputer, Noveno Encuentro Nacional de Investigadores y Usuarios del Método de Elementos Finitos en la Argentina (ENIEF 95, Bariloche, Rio Negro), November 10, 1995.
Parallel scientific computing applied to numerical modelling in geophysics, Primer Coloquio Latinoamericano de Matemática Aplicada a la Industria y la Medicina, Facultad de Ingeniería, Universidad Nacional de Buenos Aires, December 1, 1995.

Invited Talks 1994

Space-frequency domain approximation of waves in attenuating media, MECOM '94, November 8, 1994, Mar del Plata, Argentina.
A domain decomposition procedure for the numerical simulation of waves in dispersive media, 18th Conference of the Asociación Argentina de Geodesia y Geofisica, October 1994, La Plata, Argentina.

Invited Talks 1993

Numerical simulation of waves in fluid-saturated porous media, Institute for Advanced Study, Princeton, New Jersey, March 8, 1993.
Parameter estimation from seismic data using optimization techniques, Departamento de Geofísica Aplicada, Universidad Nacional de La Plata, June 28, 1993.

Invited Talks 1991

Analysis of the high frequency Biot equations, Purdue University, Center for Applied Mathematics, February 26, 1991.
Scattering of waves in Biot media, Asociación Argentina de Mecánica Computacional, Paraná, September 24, 1991.
Approximate solution of the equation of motion for nearly elastic solids, Argentine Nuclear Society, Buenos Aires, November 12, 1991.

Invited Talks 1990

Wave propagation in Biot media (part 1), Purdue University, Center for Applied Mathematics, November 27, 1990.
Wave propagation in Biot media (part 2), Purdue University, Center for Applied Mathematics, November 29, 1990.

Invited Talks 1989

Waves in porous media, Purdue University, Center for Applied Mathematics, March 2, 1989.
Wave propagation in two-phase fluid saturated porous media, Purdue University, Center for Applied Mathematics, September 5, 1989.
Wave propagation in fluid-saturated porous media, Argonne National Laboratory, Argonne, Illinois 60439, September 20, 1989.

Invited Talks 1988

A model for wave propagation in two-phase fluid-saturated porous media, Purdue University, Center for Applied Mathematics, March 22, 1988.
Generacion de microsismogramas Sintéticos por el Método de Elementos Finitos, Workshop Aplicacoes da Ciencia na Engenharia de Reservatorios de Petroleo, Rio de Janeiro, Brasil, August 19, 1988.

Invited Talks 1987

Elastic waves in composite media, Institute for Mathematics and Its Applications, University of Minnesota, May 14, 1987.

Invited Talks 1985

Finite element methods for the simulation of elastic wave propagation in fluid-saturated porous media, SEG-SIAM-SPE Conference on Mathematical and Computational Methods in Seismic Exploration and Reservoir Modelling, Houston, Texas, January 21-24, 1985.
Numerical methods for the approximate solution of Biot's low-frequency dynamic equations, Department of Mathematics, University of Chicago, February 12, 1985.
Elastic wave propagation in fluid-saturated porous media, Amoco Production Company, Research Center, Tulsa, Oklahoma, March 1, 1985.
Numerical methods for a composite model in elastodynamics, VI Congreso Latinoamericano sobre Métodos Computacionales para Ingeniería y I Congreso Argentino de Mecańica Computacional, Paraná, Argentina, October 15-18, 1985.

Invited Talks 1984

Numerical simulation of miscible displacement in porous media, PEMA-INTEC, CONICET, Guemes 3450, 3000 Santa Fe, Argentina, March 13-14, 1984.
Simulation of wave propagation in non-homogeneous elastic media, 2o Encuentro Nacional de Investigadores y Usuarios del Método de Elementos Finitos (ENIEF 84) Bariloche, Argentina, July 3, 1984.
Wave propagation in fluid-saturated porous media, Laboratorio de Computacao Cientifíca (LCC,CNPq) Rio de Janeiro, Brazil, August 17, 1984.

Funded Research Projects

13. Project Title: *Caracterización Estática y Dinámica de Reservorios no Convencionales Utilizando Simulación Numérica (Static and Dynamic Characterization of Unconventional Reservoirs using Numerical Simulation, Research Project Number PICT-2015-1909, Funded by the ANPCyT of Argentina, The National Agency for the Promotion of Science and Technology.*
Amount: U$S 40,000.
Period: 1/1/2017–31/12/2019.

12. Project Title: *Simulación Numérica en Medios Porosos Saturados, PIP 112-2011010-0777 (Numerical simulation in fluid-saturated porous media, Research Project Number 112-2011010-0777).*

Funding Institution: Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina.

Amount: $ 272.000
Period: 1/1/2014–31/12/2016.

11. Project Title: *CAPP - ONDAS (Seismic response of fractured reservoirs) Project Funded by the ANPCyT of Argentina (National Agency for the Promotion of of Science and Technology).*
This was a project based on the association of the National Petroleum Company of Argentina (YPF) and Universidad Nacional de La Plata to perform research on topics of interest for the company YPF. As part of this project, ANPCyT awarded one PhD scholarship and three graduate scholarships in the area of Geophysics.
I was the PhD advisor for the student Robiel Martínez Corredor, awarded the PhD scholarship in Universidad Nacional de La Plata, Argentina.
ANPCyT also funded travel expenses for the participant researchers and for short-term visiting consultors.
Amount: $ 28.858.970,00
Period: 1/4/2012–1/4/2014.

10. Project Title: *Métodos Numéricos para la Resolución de Problemas en en Geofísica Aplicada, PIP 112-200801-00952 (Numerical Methods for Problems Arising in Applied Geophysics, Research Project Number 112-200801-00952).*

Funding Institution: Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina.
Amount: U$S 73,500.
Period: 1/1/2009–31/12/2011.

9. Project Title: *Métodos Numéricos en Geofísica Aplicada. (Numerical Methods in Applied Geophysics).*

Funding Institution: Universidad Nacional de La Plata.
Amount: U$S 6,000.
Period: 1/01/2008–31/12/2011.

8. Project Title: *CO2 Geological Storage. Research into Monitoring and Verification Technology (CO2 ReMoVe). Project Number 518350.*

Funding Institution: European Union, Sixth Framework Programme, Sustainable Energy Systems.
Amount: EU 90,000
Period: 1/01/2009–31/12/2012.

7. Project Title: *Modelado Numérico de Propección Electrosísmica Utilizando el Método de Elementos Finitos(Numerical Modeling of Electroseismic Propecting Using the Finite Element Method).*

Funding Institution: Repsol YPF S.A., CTA.
Amount: U$S 70,000.
Period: 1/4/2007–31/12/2007.

6. Project Title: *Simulación Numérica en Geofísica Aplicada. PIP 5126/05 (Numerical Simulation in Applied Geophysics, Research Project Number 5126/05).*

Funding Institution: Consejo Nacional de Investigaciones Cientí ficas y Técnicas (CONICET), Argentina.
Amount: U$S 31,500.
Period: 1/09/2005–30/09/2007.

5. Project Title: *Simulación Numérica en Exploración Geofísica (Numerical Simulation in Exploration Geophysics).*

Funding Institution: Universidad Nacional de La Plata.
Amount: U$S 6,000.
Period: 1/01/2004–31/12/2006.

4. Project Title: *Modelado Numérico para Aplicaciones Geofísicas PICT 2003, 03-13376. (Numerical Modeling for Geophysical Applications, Project Number 03-13376.*

Funding Institution: Agencia Nacional de Promoción Científica y Tecnológica (ANPCyT). Approved by Directory of ANPCyT with approval form Number 331/04.
Amount: U$S 57,000.
Period: 1/01/2004–31/12/2006.

3. Project Title: *Proyecto para el Modelado Directo e Inverso en Geofísica Aplicada (PROMODIGA) (Forward and Inverse Modeling in Applied Geophysics).*
Supporting Institution: Consejo Nacional de Investigaciones Cientí ficas y Técnicas (CONICET), proyecto de investigación plurianual (PIP) Number 0363/98, Nro. de Resolución: D 1854/98.
Period: 9/1998–9/2001.
Amount: U$S 21,267.

2. Project Title: *Resolución Numérica de Problemas Directos e Inversos en Geofísica Aplicada (Numerical Solution of Direct and Inverse Problems in Applied Geophysics).*

Funding Institution: Universidad Nacional de La Plata.
Amount: U$S 5,100.
Period: 1/01/2001–31/12/2003.

1. Project Title: *Detection of Over–pressure Zones from Seismic and Well Data.*
Funding Institution: Observatorio Geofísico Sperimentale, Trieste, Italia, approved by the European Union. Contract Number JOF3-CT97-0036, European Union, Joule Project (DG12).
Amount: U$S 27,547.77
Period: 12/1997–12/2000.

PhD Students.

1. Claudia L. Ravazzoli.

PhD thesis title: Modeling of wave propagation phenomena in dispersive media.
University: Universidad Nacional de La Plata.
year: 1995

2. Patricia M. Gauzellino.
PhD thesis title: Numerical simulation of wave propagation phenomena in dispersive media.
University: Universidad Nacional de La Plata.
year: 1999.

3. Fabio Iván Zyserman.
PhD thesis title: Numerical modeling of electromagnetic waves with application to magnetotellurics.
University: Universidad Nacional de La Plata.
year: 2000.

4. Luis Guarracino.
PhD thesis title: Mixed methods for the numerical simulation of saturated–unsaturated flow and contaminant transport in heterogeneous porous media.
University: Universidad Nacional de La Plata.
year: 2001.

5. Germán Rubino.
PhD thesis title: Attenuation and dispersion of seismic waves in highly heterogeneous fluid-saturated porous media.
University: Universidad Nacional de La Plata.
year: 2008.

6. Robiel Martínez Corredor.
PhD thesis topic: Seismic characterization of fracture-induced velocity and Q-anisotropy in fractured porous media.
University: Universidad Nacional de La Plata.
year: 2017

7. Lucas A. Macias
PhD thesis topic: Numerical simulation of fluid flow and wave propagation in unconventional hydrocarbon reservoirs
University: Universidad de Buenos Aires.
year: in progress

Current Research Interests:

Finite-element based harmonic experiments to determine equivalent viscoelastic transversely isotropic (VTI) media long-wave equivalent to a either viscoelastic or poroviscoelastic media containing dense sets of oriented fractures.

Theoretical and numerical finite-element based analysis of velocity and Q-anisotropy in finely layered and fractured poroviscoelastic media.

Numerical modeling of fluid flow and time-lapse seismics applied to CO_2 storage and monitoring.

Finite element approximation of coupled seismic and electromagnetic waves in fluid-saturated porous media.

Seismic monitoring of hydrocarbon unconventional reservoirs.

Analysis of existence and uniqueness of solutions of the equations of thermoporoelasticity and their finite element approximations.