Ricardo **Reyes**

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I am a postdoctoral researcher in model reduction and applied math. At the moment I work developing reduced basis methods for time evolving problems. I am interested in computational fluid dynamics and computational mechanics, model reduction techniques, time evolving PDEs, and digital twins applications.

Education

Universitat Politècnica de Catalunya, BarcelonaTech
Barcelona, Spain

PH.D. IN CIVIL ENGINEERING
2014 - 2020

- Thesis: Stabilized reduced order models for low speed flows
- Advisors: Prof. Ramon Codina & Prof. Sergio Idelsohn

Universidad Nacional de Colombia
Bogota, Colombia

B.ENG. IN MECHANICAL ENGINEERING
2005 - 2010

Research experience

EPFL, École polytechnique fédérale de Lausanne
Laussane, Switzerland

POSTDOCTORAL RESEARCHER, CHAIR OF COMPUTATIONAL MATHEMATICS AND SIMULATION SCIENCE
Feb. 2021 - Present

- Development of a reduced order modelling method for time-dependent parametric problems.
- Development of a model reduction approaches linear and nonlinear structural problems for stress and fatigue analysis.
- Implementation of the new methods in a digital twin software for large-scale wind turbine application. Joint InnoSuisse project with Akselos (https://akselos.com/).

Universitat Politècnica de Catalunya
Barcelona, Spain

DOCTORAL RESEARCHER
Mar. 2014 - Mar. 2020

- Formulation of a stabilized model reduction formulation for fluid dynamics, thermodynamics and solid mechanics.
- Formulation of a hyper-reduction strategy based in adaptive mesh refinement techniques.
- Implementation of the new methods in FORTRAN code for incompressible Navier-Stokes problems, including thermally coupled and fluid-structure interaction.
- Implementation of APIs and libraries of PETSc, SLEPc, HDF5, VTK, and ParaView in a FORTRAN code for HPC applications.

Universidad Nacional de Colombia
Bogota, Colombia

GRADUATE REASERCHER
Aug. 2011 - Dec. 2012

Worked as a part of the group of modeling and numerical methods (GNUM), applying fluid and solid dynamics analysis using ANSYS and OpenFOAM in the following industrial projects:

- Fatigue analysis for a truck suspension support part, estimating dynamic loads, fatigue life and fatigue security factor.
- Turbulence analysis for the inlet pipe flow of a pump to determine the relation between the vortex length and the transverse section, by computing counter flow, static pressure, turbulent kinetic energy and dissipation energy along the pipe.
- Parametric optimization of light poles made of glass fiber based on material analysis and stress reduction.

Teaching experience

EPFL, École polytechnique fédérale de Lausanne
Lausanne, Switzerland

TEACHING ASSISTANT
Feb. 2021 - Present

- Parallel and high-performance computing. Fall 2022
- Algèbre linéaire avancée I. Fall 2021.

Universidad Nacional de Colombia
Bogota, Colombia

TEACHING ASSISTANT
Aug. 2011 - Dec. 2012

- Mathematical modelling. Spring 2012.
- Applied engineering project. Fall 2011, Fall 2012.
- Fundamentals of heat transfer. Fall 2011.

Skills

Programming	FORTRAN, Python, C/C++, MPI, LaTeX, Vim, Git
Libraries & Software	HDF5, FEniCS, PETSc, SLEPc, ParaView, Matplotlib
Languages	Spanish, English, Polish (A2), French (A2)

Awards and Funding

Universitat Politècnica de Catalunya

2020   **Cum Laude**, PhD dissertation

Ministry of Science, Technology and Innovation - Colombia

2013-2017 **PhD Fellowship**, National researcher training program

Universidad Nacional de Colombia

2011-2012 **Fellowship**, Teaching assistant position for students with an outstanding curriculum
2011   **Scholarship**, Honors for best graduate test score
2008   **Scholarship**, Honors for best grades
2004   **Scholarship**, Honors for best entrance examination score

Publications

Journal Publications

A posteriori error estimates in a finite element VMS-based reduced order model for the incompressible Navier-Stokes equations
Ramon Codina, Ricardo Reyes, Joan Baiges
Mechanics Research Communications. P. 103599, 2021. DOI: `10.1016/j.mechrescom.2020.103599`

Element boundary terms in reduced order models for flow problems: Domain decomposition and adaptive coarse mesh hyper-reduction
Ricardo Reyes, Ramon Codina
Computer Methods in Applied Mechanics and Engineering. 368: p. 113159, 2020. DOI: `10.1016/j.cma.2020.113159`

Projection-based reduced order models for flow problems: A variational multiscale approach
Ricardo Reyes, Ramon Codina
Computer Methods in Applied Mechanics and Engineering. 363: p. 112844, 2020. DOI: `10.1016/j.cma.2020.112844`

Reduced order models for thermally coupled low Mach flows
Ricardo Reyes, Ramon Codina, Joan Baiges, Sergio Idelsohn
Advanced Modeling and Simulation in Engineering Sciences. 5: 28, 2018. DOI: `10.1186/s40323-018-0122-7`

Pre-prints and in preparation

Reduced order modeling of parametrized pulsatile blood flows: hematocrit percentage and heart rate
Catalina Farias, Camilo Bayona, Ernesto Castillo, Roberto Cabrales, Ricardo Reyes
In preparation

Reduced order models for time-dependent problems using the Laplace transform
Ricardo Reyes, Fernando Henriquez, Jan Hesthaven
In preparation

Reduced Order Modeling for Parametrized Generalized Newtonian Fluid Flows
Ricardo Reyes, Oscar Ruz, Camilo Bayona, Ernesto Castillo, Alexis Tello
Journal of computational physics, Submitted. DOI: `10.2139/ssrn.4216628`

Three-Field Fluid-Structure Interaction using the Variational Multiscale Method
Alexis Tello, Ricardo Reyes, Camilo Bayona, Ramon Codina
In preparation