Ricardo **Reyes**

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I am a mechanical engineer that works developing numerical methods for time evolving problems, computational fluid dynamics and computational mechanics. I have experience in scientific computing, scientific writing, and developing algorithms and numerical methods for engineering applications. I also have experience with data analysis, and pre/post-processing tools applied to numerical simulations. I am interested in digital twins, data driven models, model order reduction, numerical methods, and computational physics.

Research experience

EPFL, École polytechnique fédérale de Lausanne   *Lausanne, Switzerland*

Postdoctoral Researcher, Chair of Computational Mathematics and Simulation Science   *Feb. 2021 - Aug. 2023*

- 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 method in a Python code using the finite element method library FEniCS.
- Implementation of the new method in a large-scale wind turbine application. (InnoSuisse project for digital twins).

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 formulated method in a FORTRAN/C++ code for incompressible Navier-Stokes problems, including thermally coupled and fluid-structure interaction.
- Implementation of the developed methods in HPC applications, using MPI, PETSc, SLEPc, HDF5 and XDMF.

Universidad Nacional de Colombia   *Bogota, Colombia*

Graduate Reasercher   *Aug. 2011 - Dec. 2012*

Worked as a graduate researcher using ANSYS and OpenFOAM in the following industrial projects:
- Fatigue analysis for a truck suspension support. Estimating dynamic loads and fatigue strength of different components.
- Turbulence analysis for the inlet pipe flow of an industrial pump. Analysis of the relation between the vortex length, the transverse section, and the turbulent behaviour along the pipe.
- Parametric optimization of fiber glass lampposts focused on stress reduction.

Education

Universitat Politècnica de Catalunya, BarcelonaTech   *Barcelona, Spain*

Ph.D. in Civil Engineering   *2014 - 2020*

- Thesis: Stabilized reduced order models for low speed flows

Universidad Nacional de Colombia   *Bogota, Colombia*

B.Eng. in Mechanical Engineering   *2005 - 2010*

Skills

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

Interests

- Model order reduction, data-driven models and machine learning.
- Computational fluid dynamics, computational mechanics, and computational physics.
- Numerical methods for partial diferential equations.

Publications

JOURNAL PUBLICATIONS

[1] Reduced order modeling of parametrized pulsatile blood flows: Hematocrit percentage and heart rate
Catalina Farías, Camilo Bayona-Roa, Ernesto Castillo, Roberto C. Cabrales, Ricardo Reyes
International Journal of Engineering Science. 193: p. 103943, 2023. DOI: `10.1016/j.ijengsci.2023.103943`

[2] Reduced order modeling for parametrized generalized Newtonian fluid flows
R. Reyes, O. Ruz, C. Bayona-Roa, E. Castillo, A. Tello
Journal of Computational Physics. 484: p. 112086, 2023. DOI: `10.1016/j.jcp.2023.112086`

[3] 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`

[4] 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`

[5] 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`

[6] 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

[1] Reduced order models for time-dependent problems using the Laplace transform
Ricardo Reyes, Fernando Henriquez, Jan Hesthaven
Submitted

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