Pedro M. Reis

Curriculum Vitae

Professional title: Professor of Mechanical Engineering
Current Address: Ecole polytechnique fédérale de Lausanne
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Date of Birth: 30th April 1978, Viseu, Portugal
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Education & Professional Preparation:

University of Manchester, UK	Physics B.Sc.	1996–1999
University of Cambridge, UK	Applied Mathematics (Part III) C.A.S.M.	1999–2000
University of Manchester, UK	Physics Ph.D.	2000–2004
City College of New York, USA	Post-doc: Granular Media	2004–2005
ESPCI/CNRS, Paris, France	Post-doc: Mechanics of Thin Sheets	2005–2007

Employment history:

2017– : Full Professor, Institute of Mechanical Engineering (IGM), EPFL.
2017– : Visiting Associate Professor, Department of Civil & Environmental Engineering (CEE), Massachusetts Institute of Technology (MIT).
2014–2017: Gilbert W. Winslow Associate Professor of Mechanical Engineering (MechE) and CEE, MIT.
2013–2014: Assistant Professor of MechE and CEE, MIT;
2010–2013: Harold E. Edgerton Assistant Professor of MechE and CEE, MIT;
2007–2010: Instructor in Applied Mathematics, Department of Mathematics, MIT.

Institutional responsibilities:

- Research Commission, Regular member, EPFL (2018 -).
- Faculty Search Committee, Chair, IGM, School of Engineering (STI), EPFL (2018-2019).
- Faculty Search Committee, Regular member, IGM, STI, EPFL (2017-2018).
- MMEC (Mechanics: Modelling, Mechanics & Computation) Seminar Series, Co-organizer, MIT (2009-2017).
- Undergraduate Education Committee, Regular member, CEE, MIT (2016).
- Digital Learning Committee, Regular member, CEE, MIT (2016).
- Faculty Search Committee, Regular member, CEE, MIT (2012–15).
- CEE Research Speed Dating Event. Co-founder and co-organizer, CEE, MIT (2011–15).
- Pierce Lab Space Council, Regular member, CEE, MIT (2014).
- MIT International Science and Technology Initiatives (MISTI), MIT-France Seed Fund Selection Board (2014).
- Department Head (CEE) Search Advisory Committee, School of Engineering, Regular member, MIT (2013).
- MechE Research Speed Dating Event. Co-founder and co-organizer, CEE, MIT (2011).
- Mechanical Engineering Strategic Planning Exercise, Regular member, MIT (2011).
- Graduate Admissions Committee. Area 1 (Mechanics), Regular member, MechE, MIT (2009–11).

Research Synopsis: Prof. Reis centers his research and educational interests in the field of the mechanics of solids and structures, with an emphasis in the (in)stability of structures and geometric nonlinearities. The mission of his research group is to harvest mechanical instabilities, especially buckling, guided primarily through precision model experiments and novel computational approaches, towards understanding and exploiting novel functionalities in slender structures over a wide range of length scales. His work is rooted on the basis of recognizing precision model experiments as powerful tools for discovery and exploration in mechanics, supported by theory and computation, in a vision of science-enabled engineering and engineering-motivated science. Prof. Reis also leverages his passion for research to educate the next generation of engineers who recognize the importance of creativity, coupled with the predictive power of mechanics, to analyze and design structural systems; from new devices to infrastructure. At EPFL, Prof. Reis directs the Flexible Structure Laboratory (fleXLab), more information on which can be found in the following link: https://flexlab.epfl.ch/ .

Awards and Honors:

♦ Elected to Fellow of the American Physical Society (2017); ♦Thomas Hughes Young Investigator Award, American Mechanics Division, American Society of Mechanical Engineers (2016); ♦Early Career Award for Soft Matter Research, American Physical Society (2016); ♦Teaching with Digital Technology Award, Office of Digital Learning, MIT (2016); ♦ Gilbert W. Winslow Chair, MIT (2014); ♦ Faculty Early Career Development (CAREER) Award, National Science Foundation (2014); ♦ Brilliant 10, Popular Science Magazine (2013); ♦ Visiting Professor, ESPCI, Paris (2012); ♦ Portuguese American Post-Graduate Society Leadership Award (2012); ♦ Harold Edgerton Chair, MIT (2010); ♦ Skinner Prize, Royal Society of Chemistry (2002); ♦ John Bink Prize, University of Manchester, UK (2002); ♦ John Bink Prize, University of Manchester (2002); ♦ Benefactor's Scholarship, St. John's College, Cambridge, UK (2000); ♦ Platt Prize, University of Manchester, UK (1999); ♦ PPARC Award for the Best Physics Student in the UK, The Science, Technology and Engineering Awards (1998); ♦ Hatfield Scholarship, University of Manchester (1998); ♦ Delta Prize, University of Manchester (1997).

Teaching activities:

♦ Mechanics and Materials II (2.002), MechE, MIT, Lab Instructor (2011), Lead lecturer (2012-17);

♦ Introduction to Engineering Design (1.001), CEE, MIT, Lab instructor (2010-16), Lead lecturer (2016-17);

♦ Nonlinear Dynamics II: Continuum Systems (18.354), Mathematics, MIT, Lead lecturer (2009-10).

♦ Undergrad. Seminar in Physical Applied Mathematics (18.384), Mathematics, MIT, Lead lecturer (2008-09).

♦ Multivariable Calculus, Mathematics, Recitation Instructor, (2007-09).

♦ **Education Innovation for Online-Learning:** During the springs of 2012 and 2013, Prof. Reis developed and performed a series of educational experiments in an online format, within his class – 2.002: Mechanics & Materials II (Mechanical Eng.). In Spring 2012, this course was the first MIT course to be offered concurrently on-campus and online, predating the MITx and edX platforms. The goal was to allow for MIT students out-of-campus to take the classes just as if they were on campus, for credit (online access to lectures, lab-material and online evaluation of problem-sets and exams). An interactive website (http://i2002.mit.edu) was custom-built with indexed and browsable video content, in a concept-map structure. Between 2012 and 2017, numerous digital tools have been deployed into the classroom of 2.002 to enhance the education of on-campus students.

Memberships and Service of Professional Societies and Foundations:

♦ American Physical Society (APS): GSOFT Executive Committee, Member-at-large (2016-2019).

♦ American Society of Mechanical Engineers (ASME): Member of the Executive Committee of the American Mechanics Division, Recording Secretary (2016-2019).

♦ Society of Engineering Science (SES): Member of the Board of Directors (2016-2019).

♦ Reviewer panelist, National Science Foundation, USA: Civil, Mechanical and Manufacturing Innovation (CMMI) Division, Mechanics of Materials Program (MoM-x): general proposals (2011), CAREER proposals (2011, 2016); Division of Materials Research (2014).

♦ Proposal reviewer: Netherlands Organization for Scientific Research, NWO (2017).

Organization of conferences:

♦ Organizer of Solvay Workshop on "Mechanics of slender structures in physics, biology and engineering: from failure to functionality", Brussels, Belgium (2018). ♦ Organizer of "Fluids-Structure Interaction" symposium, Annual Meeting of the Society of Engineering Science, Madrid, Spain (2018). ♦ Founded and organized the focus sessions "*Extreme Mechanics: Elasticity and Deformation*" at the March Meeting, APS in New Orleans (2008), Pittsburgh (2009), Portland (2010), Dallas (2011), Boston (2012), Baltimore (2013), Denver (2014), San Antonio (2015), Baltimore (2016), New Orleans (2017), Los Angeles (2018), and Boston (2019). These sessions (now with over 100 contributed talks per year) have become the primary venue for the engineering mechanics and nonlinear physics communities to come together and interact. ♦ Founded and co-organized the annual one-day workshop "*NEW.Mech: New England Workshop on the Mechanics of Materials and Structures*" held at Harvard University (2010), MIT (2011), Brown University (2012), Northeastern University (2013), U. Massachusetts Amherst (2014), Boston U. (2015), and Harvard (2016). The goal was to convene the New England Mechanics community with interest in exploring new directions on the Mechanics of Soft Materials and Structures and share the latest advancements in the field. With the hope of making it a recurring yearly event, the eighth installment of *NEW.Mech* is scheduled to take place at MIT, in October 2017. ♦ "*Engineering Mechanics in the Oilfield*" Minisymposium, International Congress of Mechanical Engineering, ASME (2013, 2014, 2015), Co-organizer. ♦ "*Designer Matter*" Workshop, AMOLF, Amsterdam, NL (2015), Co-organizer.

Ph.D. theses supervised:

- **Anna Lee:** Ph.D. awarded in 2017, Department of Mechanical Engineering, MIT, USA.
  * **Thesis Title:** "Fabrication and Buckling of Thin Spherical Shells Containing Precise Geometric Imperfections." * **Scientific Impact:** 4 peer-reviewed publications in Journal of Applied Mechanics (2017a, 2017b, 2016), Nature Communications (2016). One manuscript in preparation. 1st place for the best talk award at NEW.Mech (New England Workshop for the Mechanics of Materials and Structures) at Harvard University (22/10/2016). Awardee of a graduate fellowship from the Kwanjeong Educational Foundation, Korea (2013-17) * **Current Professional Status:** Post-doc at EPFL.

- **Mark Guttag:** Ph.D. awarded in 2017, Department of Mechanical Engineering, MIT, USA.
  * **Thesis Title:** "Aerodynamic Drag on Deformable and Active Structures in High Reynolds Number Conditions." * **Scientific Impact:** 2 peer-reviewed publications in Physical Review Fluids (2018, 2017). One manuscript in preparation. Awarded National Defense Science & Engineering Graduate Fellowship, U.S.A. (2013-17). * **Current Professional Status:** Post-doc at EPFL. Effective 01/06/2018: Research Associate, Exponent, USA.

- **M. Khalid Jawed:** Ph.D. awarded in 2016, Department of Mechanical Engineering, MIT, USA.
  * **Thesis Title: "**Geometrically nonlinear configurations in rod-like structures." * **Scientific Impact:** 8 peer-reviewed publications: Proc. Natl. Acad. Sci. U.S.A. (2017, 2014), Physical Review Fluids (2017), Soft Matter (2016), Physical Review Letters (2015a, 2015b), Journal of Applied Mechanics (2015), Extreme Mechanics Letters (2015). One manuscript in review: Nano Letters (2018). 1st place of the Best Poster Competition at the 5th NEW.Mech (New England Workshop for the Mechanics of Materials and Structures) at UMass Amherst (16/10/2014). Winner of the GSNP's Best Student Speaker Award at the March Meeting of the American Physical Society in Denver, CO (04/03/2014). * **Current Professional Status:** Assistant Professor, University of California Los Angeles (UCLA), USA.

- **James Miller:** Ph.D. awarded in 2014, Department of Civil & Environmental Engineering, MIT, USA.
  * **Thesis Title:** "Sinusoidal to Helical Buckling of Rods under Cylindrical Constraints." * **Scientific Impact:** 6 peer-reviewed publications: International Journal of Solids and Structures (2015), Extreme Mechanics Letters (2015), Journal of Applied Mechanics (2015), Physical Review Letters (2014), Soft Matter (2013), Journal of Mechanics and Physics of Solids (2013). Awarded MIT Civil Engineering Department Parlamis Fellowship for structural engineering (2010). * **Current Professional Status:** Research Scientist, Exponent, USA.

Ph.D. theses currently being supervised:

- **Paul Johanns:** Thesis defense expected 2021, EDME, EPFL. * **Thesis title (expected):** "Mechanics of Knots"**.**
- **Changyeob Baek:** Thesis defense expected 2019, Department of Mechanical Engineering, MIT, USA. **Thesis title (expected):** "Mechanics of Elastic Gridshells" * **Scientific Impact:** 1 peer-reviewed publications: Proceedings of the National Academy of Sciences USA (2016-17). One manuscript in preparation.

Other Mentoring, Advising and Students (current activity in parenthesis):

● **Current Post-Docs:** Paul Grandgeorge, Anna Lee, Matteo Pezzulla, Dong Yan. ● **Former post-docs:** Mark Guttag (Research Scientist, Exponent), Hussain Karimi (Data Scientist, Wayfair), Joel Marthelot (post-doc Princeton), Pierre-Thomas Brun (Assistant Prof. Princeton), Francisco Lopez Jimenez (Assistant Prof. UC Boulder, USA), Arnaud Lazarus (Assistant Prof. UMPC, France), Denis Terwagne (Assistant Prof. ULB, Belgium), Miha Brojan (Lecturer, U. Ljubljana, Slovenia), Romain Lagrange (Research Engineer, CEA, France), Tianxiang Su (Research Scientist, Schlumberger, USA). ● **Prior M.Sc. [research] students:** Alice Nasto (Ph.D. MIT), Connor Mulcahy (Boston Scientific), Laelia Kim-Lan Vaulot (M.Arch. Yale), Elizabeth Strong (Ph.D. student UC Boulder), Rashed Al-Rashed (Ph.D. student MIT), Grace Goon (Ph.D. student MIT). ● **B.Sc. thesis advised:** Marie Rice (2014); Noor Khouri (2015); Ryan McDermott (2015); Connor McMahan (2015).

Selected list of 20 publications in the past 5 years:
(A full publication list can be found in the following webpage: https://flexlab.epfl.ch/publications/)

- Marthelot J., Strong E.F., **Reis P.M.**, and Brun P.-T., "Designing soft materials with interfacial instabilities in liquid films" *Nature Communications* **9**, 4477 (2018).
- Baek C., Sageman-Furnas A.O., Jawed M.K. and Reis P.M., "Form finding in elastic gridshells" Proceedings of the National Academy of Sciences U.S.A. **115**, 75 (2018).**
- Jawed M.K., Hadjiconstantinou N., Parks D., Reis P.M., "Patterns of carbon nanotubes by flow-directed deposition on substrates with architectured topographies" *Nano Lett.* **18**, 1660-1667 (2018).
- Marthelot J., Brun P.-T., López Jiménez F. and **Reis P.M.**, "Reversible patterning of spherical shells through constrained buckling" Physical Review Materials **1**, 025601 (2017). **
- Lee A., Brun P.-T., Marthelot J., Balestra G., Gallaire F. and **Reis P.M.**, "Fabrication of slender elastic shells by the coating on curved surfaces," *Nature Communications* **7** 11155, 1 (2016).**
- Mulcahy C.G., Su T., Wicks N. and **Reis P.M.**, "Extending the reach of a rod injected into a cylinder through axial vibration" *Journal of Applied Mechanics* **83**(5), 051003, 1 (2016).**
- López Jiménez F., Upadhyaya P., **Reis P.M.** and Kumar S., "Soft optical composites for tunable transmittance." *Extreme Mechanics Letters* **9**, 297-303 (2016).**
- López Jiménez F., Stoop N., Lagrange R., Dunkel J. and **Reis P.M.**, "Curvature-Controlled Defect Localization in Elastic Surface Crystals," *Physical Review Letters* **116**, 104301, 1-5 (2016).**
- Lee A., López Jiménez F., Marthelot J., Hutchinson J.W. and **Reis P.M.**, "The Geometric Role of Precisely Engineered Imperfections on the Critical Buckling Load of Spherical Elastic Shells" *Journal of Applied Mechanics* **83**(11), 111005, 1 (2016).**
- **Reis P.M.**, "A Perspective on the Revival of Structural (in)stability with Novel Opportunities for Function: from Buckliphobia to Buckliphilia," *Journal of Applied Mechanics* **82**, (11), 111001, 1 (2015).
- **Reis P.M.**, Jaeger H.M., and van Hecke M., "Designer Matter" *Extreme Mechanics Letters* **5**, 29 (2015).
- Jawed M.K., Dieleman P., Audoly B. and **Reis P.M.**, "Untangling the Mechanics and Topology in the Frictional Response of Long Overhand Elastic Knots," *Physical Review Letters* **115**, 118302, 1 (2015).**
- Brojan M., Terwagne D., Lagrange R. and **Reis P.M.**, "Wrinkling crystallography on spherical surfaces," *Proceedings of the National Academy of Sciences of the U.S.A.* **112**(1), 14 (2015). **
- Stoop N., Lagrange R., Terwagne D., **Reis P.M.** and Dunkel J., "Curvature-induced symmetry breaking of elastic surface patterns," *Nature Materials* **14**, 337 (2015). **
- Miller J.T., Su T., Dussan E.B., Pabon J., Wicks N., Bertoldi K. and **Reis P.M.**, "Buckling-induced lock-up of a slender rod injected into a horizontal cylinder," *International Journal of Solids and Structures* **72**, 153 (2015).**
- Jawed M. K., Khouri N., Da F., Grinspun E. and **Reis P.M.**, "Propulsion and instability of flexible helical rod rotating in a viscous fluid," *Physical Review Letters* **115**, 168101, 1 (2015).**
- Miller J.T., Lazarus A., Audoly B. and **Reis P.M.**, "Shapes of a Suspended Curly Hair," *Physical Review Letters* **112**, 068103, 1 (2014).**
- Jawed M.K., Da F., Joo J., Grinspun E. and **Reis P.M.**, "Coiling of elastic rods on rigid substrates," *Proceedings of the National Academy of Sciences of the U.S.A.* **111**(41), 14663 (2014).**
- Terwagne D., Brojan M., and **Reis P.M.,** "Smart Morphable Surfaces for Aerodynamic Drag Control," *Advanced Materials* **26**(38), 6608 (2014).**
- Lazarus A., Miller J.T. and **Reis P.M.**, "Continuation of equilibria and stability of slender elastic rods using an asymptotic numerical method," *Journal of the Mechanics and Physics of Solids* **61**, 1712 (**2013**).**

** Outgrowth of supervised student or postdoc research.