

**Marcelo A. Dias**

Department of Engineering  
 Aarhus University  
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**Professional Experience**

- 2017 – Assistant Professor, Department of Engineering, Aarhus University, Aarhus, Denmark
- 2016 – 2017 Assistant Professor, Dep. of Physics and Astro., James Madison University, Harrisonburg VA, USA
- 2017 (June) Visiting Assistant Professor, École Normale Supérieure de Lyon, France
- 2017 (May) Visiting Assistant Professor, PMMH, ESPCI, Paris, France
- 2014 – 2016 Research Fellow, Aalto Science Institute (ASCI), Aalto University, Espoo, Finland & Nordita, Royal Institute of Technology and Stockholm University, Stockholm, Sweden
- 2014 – 2014 Lecturer (Instructor), School of Engineering, Brown University, Providence, RI, USA
- 2012 – 2014 Postdoctoral Research Associate, School of Engineering, Brown University, Providence, RI, USA
- 2008 – 2012 Research Assistant, Department of Physics, University of Massachusetts, Amherst, MA, USA
- 2007 – 2010 Teaching Assistant, Department of Physics, University of Massachusetts, Amherst, MA, USA

**Education**

- 2007 – 2012 Ph.D. in Physics, University of Massachusetts Amherst, Amherst, MA, USA  
 Dissertation: “Swelling and folding as mechanisms of 3D shape formation in thin elastic sheets.”
- 2005 – 2007 M.Sc. in Physics, Theoretical Physics Institute – IFT, São Paulo, SP, Brazil  
 Dissertation: “A geometrical approach for localization principles in functional integrals.”
- 2001 – 2005 B.Sc. in Physics, State University of São Paulo – UNESP, Rio Claro, SP, Brazil  
 Dissertation: “Topics in quantum mechanics.”

**Research interests**

Mechanical and structural engineering; Theoretical and computational physics; Plates and shells; Soft Condensed Matter Physics; Fluid dynamics and fluid-structure interactions; Applied mathematics; Biomechanics; 3D printing; Scientific writing; STEM education (science, technology, engineering and mathematics).

**Honors, awards, and funding**

1. VILLUM Experiment grant (2018)—VILLUM FONDEN
2. Recipient of the 4-VA at JMU—Fall 2016 and 2017 Collaborative Research Grants
3. Recipient of the Aalto Science Institute Science Factories
4. Nordic Institute for Theoretical Physics (Nordita) Fellowship
5. Aalto Science Institute (ASCI) Fellowship

6. University of Massachusetts Amherst—Kandula Sastry graduate thesis award (2014)
7. Oxford Centre for Collaborative and Applied Mathematics (OCCAM) Studentship, University of Oxford (2012).
8. “Coordenação de Aperfeiçoamento de Pessoal de Nível Superior”—CAPES Fellowship—funds secured for 2005-2007.
9. Theoretical Physics Institute Foundation (FIFT Fellowship)—funds secured for 2004.

## List of publications

### Available preprints and submitted work

1. N. P. Bende, T. Yu, N. A. Corbin, M. A. Dias, C. D. Santangelo, J. A. Hanna, and R. C. Hayward, “Overcurvature induced multistability of linked conical frusta: How a ‘bendy straw’ holds its shape” [Soft Matter](#), **14**, 8636-8642 (2018).
2. Y. Yang, M. A. Dias, and D. P. Holmes, “Tunable Stiffness Using Multistable Kirigami” Accepted. [ArXiv](#) (2018).
3. M. Venkadesan, M. A. Dias, D. K. Singh, M. M. Bandi, and S. Mandre, “Stiffness of the human foot and evolution of the transverse arch” [ArXiv](#) (2017).

### Journal publications

- 2018
4. D. Rayneau-Kirkhope, C. Zhang, L. Theran, and M. A. Dias, “Analytic analysis of auxetic metamaterials through analogy with rigid link systems” [Proceedings of the Royal Society A](#), **474**, 2210 (2018).
  5. D. J. Rayneau-Kirkhope and M. A. Dias, “Built on instability”, [On your wavelength, Physics blog from Nature Journals](#) (2018).
- 2017
6. M. A. Dias, M. P. Mccarron, D. Rayneau-Kirkhope, P. Z. Hanakata, D. K. Campbell, H. S. Park, and D. P. Holmes, “Kirigami Actuators” [Soft Matter](#), **13** (48), 9087-9092 (2017).
  7. D. Rayneau-Kirkhope and M. A. Dias, “Embracing Failure”, [Physics World](#), **30**, No 8, 25 (2017).
- 2016
8. D. Rayneau-Kirkhope and M. A. Dias, “Recipes for selecting failure modes in 2-d lattices”, [Extreme Mechanics Letters](#), **9**, 11-20 (2016).
  9. E. Aurell, S. Bo, M. A. Dias, R. Eichhorn, and R. Marino, “Diffusion of a Brownian ellipsoid in a force field”, [Europhysics Letters](#), **114**, 30005 (2016).
- 2015
10. M. Krieger, M. A. Dias, and T. R. Powers, “Minimal model for transient swimming in a liquid crystal”, [The European Physical Journal E](#) **38**, 8, 94 (2015).
  11. M. A. Dias and B. Audoly, “‘Wunderlich, meet Kirchhoff’: A general and unified description of elastic ribbons and thin rods”, [Journal of Elasticity](#) **119**, 1, 49-66 (2015). Also in Book Chapter: Roger Fosdick and Eliot Fried, editors, *The Mechanics of Ribbons and Möbius Bands*, chapter 7, pages 49-66. Springer Netherlands (2016).
- 2014
12. M. A. Dias and B. Audoly, “A non-linear rod model for folded elastic strips”, [Journal of the Mechanics and Physics of Solids](#) **62**, 57 (2014).
- 2013
13. M. A. Dias and T. R. Powers, “Swimming near deformable membranes at low Reynolds number”, [Physics of Fluids](#) **25**, 101901 (2013).
- 2012
14. M. A. Dias, “Swelling and Folding as Mechanisms of 3D Shape Formation in Thin Elastic Sheets”, University of Massachusetts Amherst, Doctoral dissertation, [Scholarworks @ UMass](#), (2012).
  15. M. A. Dias and C. D. Santangelo, “The shape and mechanics of curved-fold origami structures”, [Europhysics Letters](#) **100**, 54005 (2012).
  16. M. A. Dias, L. Dudte, L. Mahadevan, C. D. Santangelo, “Geometric Mechanics of Curved Crease Origami”, [Physical Review Letters](#) **109**, 114301 (2012). Featured in [Physics - Synopsis: Folding on the Curve](#) and [IOP Physics World](#).

- 2011 17. M. A. Dias, J. A. Hanna, and C. D. Santangelo, “Programmed buckling by controlled lateral swelling in a thin elastic sheet”, [Physical Review E \*\*80\*\*, 036603 \(2011\)](#).

#### **Publications in preparation**

18. M. Krieger, T. R. Powers, and M. A. Dias, “Wrinkling instability in thin nematic elastomer sheet”.
19. M. A. Dias and D. Rayneau-Kirkhope, “Post-buckling analysis of 2-d lattices and their auxetic behaviour”.
20. T. I. Löbbling, M. A. Dias, A. H. Gröschel and O. Ikkala, “Tomographic observation of structure-directing topological defects in self-assembled polymer sheets and polymersomes”.

#### **Language**

1. Portuguese (mother tongue)
2. English (fluent)
3. Spanish (very basic communication skills—listening and reading)

#### **Other professional activities**

1. Referee for Thin-Walled Structures.
2. Referee for The European Physical Journal Plus.
3. Referee for Physical Review Letters.
4. Referee for Physical Review E.
5. Referee for Journal of Elasticity.
6. Jan 25 to Feb 12, 2016. KITP program in Geometry, Elasticity, Fluctuations, and Order in 2D Soft Matter.
7. Workshop Organizer: “[Statistical Physics and Mechanics of Forms and Shapes](#)”, Mariehamn, Åland, Finland.
8. Fall 2013 – Spring 2014. The Sheridan Center for Teaching & Learning Brown University – Certificate I
9. Organizer of the Fluids Journal Club Spring of 2013 at the School of Engineering, Brown University.
10. July 5 – July 29, 2011. The Boulder School for Condensed Matter and Materials Physics – Hydrodynamics.
11. Member of the American Physical Society since November of 2009.

#### **Visiting researcher**

1. June 2016 – Okinawa Institute of Science and Technology, Okinawa, Japan
2. Jan. 25 to Feb. 12, 2016 – Kavli Institute for Theoretical Physics (KITP), Santa Barbara, CA
3. November 2015 – École normale supérieure - Paris, France
4. April 2015 – University of Cambridge – Corpus Christi College, Cambridge, UK
5. June 2014 – Okinawa Institute of Science and Technology, Okinawa, Japan
6. August 2013 – Virginia Polytechnic Institute and State University, Blacksburg, VA, USA
7. April 2013 – Instituto de Ciencias Nucleares, UNAM, Mexico City, Mexico
8. July 2012 – University of Oxford – Oxford Centre for Collaborative Applied Mathematics, Oxford, UK
9. June 2012 – Institut de mécanique d’Alembert – Université Paris 6, Paris, France
10. Summer 2008 – Albert Einstein Institute – Max Planck Institute, Golm, Germany
11. Summer 2006 – Department of Mathematics, University of Massachusetts, Amherst, MA, USA

**Invited talks in conferences**

1. May 24, 2018, Geometry of Soft Matter, “Using paper-cutting as a strategy for 3D shape-change”. International Institute of Physics, Natal, Brazil.
2. November 22, 2017, Recent Advances in Mechanics and Mathematics of Materials, “Kirigami actuators”. Sapienza University of Rome, Italy.
3. May 12, 2015, HYBER Symposium, “Mechanics of shape formation and controlled actuation in thin sheets of liquid-crystal elastomers”. Espoo, Finland.
4. March 26, 2015, ESPCI – Workshop on Folding and Creasing of Thin Plate Structures, “Wunderlich-Kirchhoff Model and its Application to Curved Creases”. Paris, France.
5. February 25, 2015, NORDITA – The 6th Nordic Workshop on Statistical Physics: Biological, Complex and Non-Equilibrium Systems, “Mechanics of shape formation and controlled actuation in thin sheets of liquid-crystal elastomers”. Stockholm, Sweden.
6. December 4, 2012, Princeton University – Through the Looking Glass: A Glimpse into the Geometry and Topology of Matter, “Origami folded isometric embeddings”. Princeton NJ, USA.
7. September 5, 2012, Lorentz Center – Modern Perspectives on Thin Sheets: Geometry, Elasticity, and Statistical Physics, “Folding as a Mechanism of 3D Shape Formation in Thin Elastic Sheets”. Leiden, Netherlands.
8. May 20, 2011, IMA – Strain Induced Shape Formation: Analysis, Geometry and Materials Science, “Curved Fold Origami”. Minneapolis MN, USA.

**Invited lectures**

1. March 20, 2018, NORDITA – Complex systems and Biological physics seminar, “Kirigami mechanisms and mechanical metamaterials”.
2. June 2, 2017, PMMH, l'École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris–ESPCI—Seminar, “Kirigami and Biomechanics”.
3. January 16, 2017, Department of Engineering, Aarhus University—Seminar, “Thin elastic structures: a roadmap from forms to functions”.
4. May 12, 2016, Aalto School of Science, Applied Physics Department – Complex systems and materials group seminar, “Thin elastic structures: a roadmap from forms to functions”.
5. January 29, 2016, California Polytechnic State University, Physics and Astronomy Department—Seminar, “Thin elastic structures: a roadmap from forms to functions”.
6. January 25, 2016, James Madison University, Physics and Astronomy Department—Seminar, “Thin elastic structures: a roadmap from forms to functions”.
7. December 3, 2015, Laboratoire de Mécanique des Solides, École polytechnique—Seminar, “Mechanics of shape design and controlled actuation in thin sheets”.
8. November 24, 2015, Institut de mécanique d'Alembert, Université Paris 6—Seminar, “Thin Elastic Structures: A roadmap from forms to functions”.
9. June 1, 2015, Department of Forest Products Technology, School of Chemical Technology—Seminar, “Mechanics and Geometry of Complex Structures: A pathway towards functions of forms”.
10. March 20, 2015, Aalto School of Science, Applied Physics Department—Seminar, “Mechanics of shape formation and controlled actuation in thin sheets of liquid- crystal elastomers”.
11. September 16, 2014, NORDITA – Complex systems and Biological physics seminar, “Mechanics and Geometry of Complex Structures: A pathway towards functions of forms”.

12. August 22, 2014, Aalto School of Science, Applied Physics Department—Seminar, “Mechanics and Geometry of Complex Structures: A pathway towards functions of forms”.
13. June 17, 2014, Okinawa Institute of Science and Technology—Seminar, “Mechanics and Geometry of Complex Structures: A pathway towards functions of forms”.
14. September 24, 2013, Harvard University, School of Engineering and Applied Sciences – Bertoldi’s group Seminar, “Form and function”.
15. April 28, 2013, Instituto de Ciencias Nucleares, UNAM – Colloquium, “Origami folded isometric embeddings”.
16. January 28, 2013, Brown University – Applied mathematics seminar, “Origami folded isometric embeddings”.
17. November 26, 2012, University of Pennsylvania—Seminar, “Folding as a Mechanism of 3D Shape Formation in Thin Elastic Sheets”.
18. July 13, 2012, ESPCI – PMMH Seminars, “Folding as a Mechanism of 3D Shape Formation in Thin Elastic Sheets”.
19. December 15, 2011, Brown University – Condensed Matter Seminar, “Designing 3D Shapes by Patterning 2D Sheets”.
20. November 8, 2011, Mount Holyoke College – Physics Department Colloquium, “The Science of Curved Fold Origami”.
21. May 27, 2011, University of Massachusetts Amherst – Graduate Student Seminars, “Unfolding Mysteries with Gauss Maps”.
22. October 1, 2010, University of Massachusetts Amherst – Graduate Student Seminars, “1D Variational Problems for Elasticity of Curves”.
23. May 14, 2010, University of Massachusetts Amherst – Graduate Student Seminars, “Möbius Strip, Differential Geometry in Thin Film Theory”.
24. September 2006, Department of Mathematics and Statistics – University of Massachusetts Amherst, Lecture on Geometric Relativity and Cosmology.

### Contributed presentations

1. July 2, 2018, Talk, with D. K. Campbell, M. P. Mccarron, D. Rayneau-Kirkhope, P. Z. Hanakata, H. S. Park, and D. P. Holmes, “Kirigami Actuators”, The 10th European Solid Mechanics Conference (ESMC) 2018, Bologna, Italy.
2. March 6, 2018, Talk, with D. K. Campbell\*, M. P. Mccarron, D. Rayneau-Kirkhope, P. Z. Hanakata, H. S. Park, and D. P. Holmes, “Kirigami Actuators”, APS March Meeting 2018, Los Angeles, California, USA.
3. March 16, 2017, Talk, with M. P. Mccarron, D. Rayneau-Kirkhope, and D. P. Holmes, “Cracking Sheets into Shapes: Linear actuators from non-linear crack behavior”, APS March Meeting 2017, New Orleans, Louisiana, USA.
4. October 4, 2016, Talk, “Mechanics of cracks in thin sheets”, The Society of Engineering Science (SES) Technical Meeting, College Park, MD, USA.
5. May 13, 2016, Talk, “Thin elastic structures: a roadmap from forms to functions”, Nordita Day, Stockholm, Sweden.
6. January 2016, Talk, with S. Mandre\*, D. K. Singh, M. M. Bandi, M. Venkadesan, “Evolution of the transverse arch made the human foot stiffer”, The Society for Integrative and Comparative Biology (SICB), SICB 2016 Meeting, Portland, OR, USA.

7. March 2015, Talk, with D. K. Singh, M. M. Bandi, M. Venkadesan, and S. Mandre, “Role of the transverse arch in stiffness of the human foot”, APS March Meeting 2015, San Antonio, Texas, USA.
8. March 2015, Talk by M. Krieger\*, with T. R. Powers, “Wrinkling in thin nematic elastomers”, APS March Meeting 2015, San Antonio, Texas, USA.
9. June 2014, Poster, with T. R. Powers, “Swimming near deformable membranes at low Reynolds number”, OIST Workshop: Dynamics at Interfaces, Okinawa, Japan.
10. November 2013, Talk, with T. R. Powers, “Swimming near deformable membranes at low Reynolds number”, APS DFD Meeting 2013, Pittsburgh, PA, USA.
11. March 2013, Poster, with T. R. Powers, “Swimming near a deformable interface”, APS March Meeting 2013, Baltimore, MD, USA.
12. March 2013, Talk, with B. Audoly, “A rod theory for pleated elastic strips”, APS March Meeting 2013, Baltimore, MD, USA.
13. March 2013, Talk, with T. R. Powers, “Swimming near a deformable interface”, 54th New England Complex Fluids Workgroup, Yale University, New Haven, CT, USA.
14. November 2012, Talk, with C. D. Santangelo, “The shape and mechanics of curved fold origami structures”, New England Workshop on the Mechanics of Materials and Structures, Brown University, Providence, RI, USA.
15. July 2012, Talk, with C. D. Santangelo, “Rolling and Folding from composite polymer gels and ‘paper.’”, at the European Solid Mechanics Conference in Graz, Austria.
16. February 2012, Talk, with C. D. Santangelo, “Geometry in the Mechanics of Origami”, APS March Meeting 2012, Boston, MA, USA.
17. October 2011, Poster, with C. D. Santangelo, “Mechanics of Curved Crease Origami”, New England Workshop on the Mechanics of Materials and Structures, MIT, Cambridge, MA, USA.
18. August 2011, Poster, with C. D. Santangelo, “Mechanics of Curved Crease Origami”, Gordon Research Conference on Soft Condensed Matter Physics, Colby-Sawyer College, New London, NH, USA.
19. July 2011, Poster, with C. D. Santangelo, “Curved Fold Origami”, The Boulder School in Condensed Matter and Materials Physics, University of Colorado, Boulder, CO, USA.
20. July 2011, Talk, with C. D. Santangelo, “Curved Fold Origami”, 47th New England Complex Fluids Workgroup, University of Massachusetts, Amherst, MA, USA.
21. March 2011, Talk, with C. D. Santangelo, “Mechanics of Curved Folds”, APS March Meeting 2011, Dallas, TX, USA.
22. December 2010, Talk, with C. D. Santangelo, “Curved Folds”, 45th New England Complex Fluids Workgroup, Harvard University, Cambridge, MA, USA.

## Teaching experience

*Department of Engineering, Aarhus University:*

- Mathematical Modeling for Applications to Science and Engineering, Fall 2018.
- Beams and Plates, Fall 2018.
- Electromagnetism and The Finite Element Method, Spring 2018.
- Beams and Plates, Fall 2017.

*Institut d'Etudes Scientifiques de Cargèse: Summer School Mechanics and Physics of Stretchable Objects (MEPHISTO)*

- Slender Structures, August 2018.

*Department of Physics and Astronomy, James Madison University:*

- PHYS 121 – The physical nature of light and sound, Spring 2017.
- PHYS 240 – University Physics I, Fall 2016.

*School of Engineering, Brown University:*

- ENGN 2020 – Mathematical Methods in Engineering and Physics II, Spring 2014.

*Teaching Assistantship at the Physics Department, University of Massachusetts Amherst:*

- Physics 154 – General Physics Laboratory II, Spring 2010 (20 hours/week).
- Physics 284 – Modern Physics I, Spring 2009 (10 hours/week).
- Physics 568/821 – General Relativity, Fall 2008 (10 hours/week).
- Physics 151 – General Physics I, Fall 2008 (10 hours/week).
- Physics 286 – Sophomore Laboratory II, Spring 2008 (10 hours/week).
- Physics 134 – Introductory Physics Laboratory II, Fall 2007 (20 hours/week).

### **Student mentoring**

1. Nicole Voce (Summer internship), “Fluid-structure interaction”, Aarhus University, May, June and July 2018.
2. Nicole Voce (Undergraduate student), “Fluid-structure interaction”, James Madison University, 2016–2017.
3. Brendan Eakin (Undergraduate student), “Construction of Funicular Structures”, James Madison University, 2016–2017.
4. Patrick Maxwell (Undergraduate student), “FEM Study of Arches”, James Madison University, 2016–2017.
5. Adam Boardwine (Undergraduate student), “Elastic Instability of Archer”, James Madison University, 2016–2017.
6. Isaac Metta (Undergraduate student), “Cutting, Pulling, Buckling: The Interplay between 3D Shape Design and Elastic Instabilities”, AScI Summer Internship program 2015.
7. Richard Chengzhao Zhang (Undergraduate student), “Mechanical Metamaterials with Negative Poisson Ratio”, AScI Summer Internship program 2015.
8. Madison S. Krieger (Graduate student), co-advising in the project “Wrinkling instability in thin nematic elastomer sheet”, 2014-2015.

### **Teaching training**

1. Fall 2018. Teacher Training Programme, Modules 1, 2, 3, and 4: Aarhus University Educational Development Network (UPNet).
2. November 17-20, 2016. Association of Physics Teachers (AAPT) Physics and Astronomy New Faculty Workshop: American Center for Physics in College Park, Maryland.
3. Fall 2013 – Spring 2014. Sheridan’s Certificate I: Brown University.
4. Fall 2010. 797NN Introduction to Scientific Teaching: Polymer Science and Engineering UMass.

**Outreach experience**

1. January 2017, Saturday Morning Physics, Harrisonburg, VA, “Geometry, Science, and Origami”.
2. May 2011, Four Rivers Charter Public School, Greenfield, MA, “The scales of the universe”.
3. May 2011, Four Rivers Charter Public School, Greenfield, MA, “Origami and science”.
4. February 2011, Hampden Charter School of Science, Chicopee, MA, “Origami and science”.
5. 2006 – 2007, Salvation Army, São Paulo, SP, Brazil. Volunteer work with homeless children.