

Davide Riccobelli

Web page: <https://riccobelli.faculty.polimi.it>
Google Scholar ID: 23vWWAUAAAAJ

Scopus ID: 57192891658
OrcID: 0000-0001-6424-5689

CURRENT POSITION	Politecnico di Milano – Dipartimento di Matematica Fixed Term Researcher in Mathematical Physics (Ricercatore a tempo determinato - tipo A)	Since Jan 2021
PAST POSITIONS	SISSA – Area di Matematica Postdoc. – Supervisor: A. De Simone	Nov 2018 to Jan 2021
VISITING PERIODS	Delft University of Technology – Host: B. Giovanardi	May 2024 to July 2024
	University of Oxford – Host: D. Vella	July 2018
	École Supérieure de Physique et de Chimie Industrielles de la Ville de Paris (ESPCI Paris) – Host: L. Truskinovsky	Apr 2017 to Oct 2017
	Université Pierre et Marie Curie – Host: C. Maurini	Sept 2017 to Oct 2017
EDUCATION	Politecnico di Milano Ph.D. in Mathematical Models and Methods in Engineering – Title of the thesis: <i>Mathematical modelling of soft and active matter</i> – Date of the thesis defence: 8 th February 2019 – Advisor: P. Ciarletta	Nov 2015 to Oct 2018
	Università Cattolica del Sacro Cuore Laurea Magistrale (M.Sc.) in Mathematics (110/110 summa cum laude)	Sept 2013 to July 2015
	Università Cattolica del Sacro Cuore Laurea (B.Sc.) in Mathematics (110/110 summa cum laude)	Sept 2011 to Sept 2013
QUALIFICATIONS	<ul style="list-style-type: none">• Italian national scientific qualification as associate professor (professore di seconda fascia) for the disciplinary fields<ul style="list-style-type: none">– 01/A4 - Mathematical Physics (valid until 3/10/2033).– 08/B2 - Structural Mechanics (valid until 27/09/2033).• French qualification for the position of Maître de conférence<ul style="list-style-type: none">– Section 26 - <i>Mathématiques appliquées et applications des mathématiques</i> (Applied mathematics).– Section 60 - <i>Mécanique, génie mécanique, génie civil</i> (Mechanics, mechanical engineering, civil engineering).	
REFEREED JOURNAL PUBLICATIONS	1. N. Barnafi, F. Regazzoni, and D. Riccobelli. Reconstructing relaxed configurations in elastic bodies: Mathematical formulations and numerical methods for cardiac modeling. <i>Computer Methods in Applied Mechanics and Engineering</i> , 423:116845, 2024	

2. Y. Su, D. Riccobelli, Y. Chen, W. Chen, and P. Ciarletta. Tunable morphing of electroactive dielectric-elastomer balloons. *Proceedings of the Royal Society A*, 479(2276):20230358, 2023.
3. D. Riccobelli, H. H. Al-Terke, P. Laaksonen, P. Metrangolo, A. Paananen, R. H. Ras, P. Ciarletta, and D. Vella. Flattened and wrinkled encapsulated droplets: Shape-morphing induced by gravity and evaporation. *Physical Review Letters*, 130(21):218202, 2023.
4. D. Andrini, V. Balbi, G. Bevilacqua, G. Lucci, G. Pozzi, and D. Riccobelli. Mathematical modelling of axonal cortex contractility. *Brain Multiphysics*, 3:100060, 2022.
5. P. Ciarletta, G. Pozzi, and D. Riccobelli. The Föppl–von Kármán equations of elastic plates with initial stress. *Royal Society Open Science*, 9(5):220421, 2022.
6. D. Riccobelli. Active elasticity drives the formation of periodic beading in damaged axons. *Physical Review E*, 104(2):024417, 2021.
7. D. Riccobelli, G. Noselli, and A. DeSimone. Rods coiling about a rigid constraint: Helices and perversions. *Proceedings of the Royal Society A*, 477(2246):20200817, 2021.
8. D. Riccobelli, G. Noselli, M. Arroyo, and A. DeSimone. Mechanics of axisymmetric sheets of interlocking and slidable rods. *Journal of the Mechanics Physics of Solids*, 141:103969, 2020.
9. D. Riccobelli and G. Bevilacqua. Surface tension controls the onset of gyrification in brain organoids. *Journal of the Mechanics Physics of Solids*, 134:103745, 2020.
10. D. Riccobelli and D. Ambrosi. Activation of a muscle as a mapping of stress–strain curves. *Extreme Mechanics Letters*, 28:37–42, 2019.
11. D. Riccobelli, A. Agosti, and P. Ciarletta. On the existence of elastic minimizers for initially stressed materials. *Philosophical Transactions of the Royal Society A*, 377(2144):20180074, 2019.
12. G. Giantesio, A. Musesti, and D. Riccobelli. A comparison between active strain and active stress in transversely isotropic hyperelastic materials. *Journal of Elasticity*, 137(1):63–82, 2019.
13. D. Riccobelli and P. Ciarletta. Morpho-elastic model of the tortuous tumour vessels. *International Journal of Non-Linear Mechanics*, 107:1–9, 2018.
14. D. Riccobelli and P. Ciarletta. Shape transitions in a soft incompressible sphere with residual stresses. *Mathematics and Mechanics of Solids*, 23(12):1507–1524, 2018.
15. D. Riccobelli and P. Ciarletta. Rayleigh–Taylor instability in soft elastic layers. *Philosophical Transactions of the Royal Society A*, 375(2093):20160421, 2017.
16. D. Ambrosi, S. Pezzuto, D. Riccobelli, T. Stylianopoulos, and P. Ciarletta. Solid tumors are poroelastic solids with a chemo-mechanical feedback on growth. *Journal of Elasticity*, 129(1-2):107–124, 2017.

CONFERENCE
PROCEEDINGS

1. D. Riccobelli. Buckling behind brittle fracture in soft solids. In P. Diehl, R. Lipton, A. Pandolfi, and T. Wick, editors, *Fracture as an Emergent Phenomenon*, volume 2024, 1 of *Oberwolfach Workshop Report*, pages 22–23, Oberwolfach (GE), 2024. Mathematisches Forschungsinstitut Oberwolfach.

SUBMITTED
JOURNAL
PUBLICATIONS

1. D. Riccobelli, P. Ciarletta, G. Vitale, C. Maurini, and L. Truskinovsky. Elastic instability behind brittle fracture in soft solids. Under review in *Physical Review Letters*
2. M. Magri and D. Riccobelli. Modelling of initially stressed solids: structure of the energy density in the incompressible limit. Under review in *Proceedings of the Royal Society A*

PRIZES, AWARDS,
TRAVEL GRANTS

1. *Research Highlights* on the paper “D. Riccobelli, H. H. Al-Terke, P. Laaksonen, P. Metrangolo, A. Paananen, R. H. Ras, P. Ciarletta, and D. Vella. Flattened and

wrinkled encapsulated droplets: Shape-morphing induced by gravity and evaporation. *Physical Review Letters*, 130(21):218202, 2023” have been published on *Nature Reviews Physics* and *Physics*:

- Z. Budrikis. Crumpling and wrinkling droplets. *Nature Reviews Physics*, 5(7):374–374, 2023
 - R. Berkowitz. Gravity Alters the Shape of an Evaporating Droplet. *Physics*, 16:s69, 2023
2. The paper “D. Riccobelli, H. H. Al-Terke, P. Laaksonen, P. Metrangolo, A. Paananen, R. H. Ras, P. Ciarletta, and D. Vella. Flattened and wrinkled encapsulated droplets: Shape-morphing induced by gravity and evaporation. *Physical Review Letters*, 130(21):218202, 2023” has been selected as *Editors’ Suggestion* by the editorial board of *Physical Review Letters*.
 3. The paper “D. Riccobelli. Active elasticity drives the formation of periodic beading in damaged axons. *Physical Review E*, 104(2):024417, 2021” has been selected as *Editors’ Suggestion* by the editorial board of *Physical Review E*.
 4. Winner of the *GADeS award 2023* for the best Ph.D. thesis in the fields of dynamics and stability defended the thesis in the period 2018-2023. The prize is awarded by the GADeS group of the Italian Association of Theoretical and Applied Mechanics (AIMETA).
 5. *Oberwolfach Leibniz Graduate Students*, travel grant to participate to a conference.
 6. Travel grants to participate to the INdAM Summer Schools on Mathematical Physics (2015, 2016, 2018, 2020).

INVITED
PRESENTATIONS

1. 19 Mar 2024: *Fracture nucleation as an elastic instability in soft solids*, seminar at the University of Trento.
2. 15 Mar 2024: *The shape of the heart*, Workshop “Heart beats in continuum mechanics”, Politecnico di Torino.
3. 8 Jan 2024: *Buckling behind brittle fracture in soft solids*, Workshop “Fracture as an Emergent Phenomenon”, Mathematisches Forschungsinstitut Oberwolfach.
4. 24 Oct 2023: *Neurological diseases and brain mechanics: A mathematical perspective*, seminar at SISSA, Trieste.
5. 11 Sept 2023: *Mathematical modelling of soft and active matter: GADeS award 2023*, GADeS – AIMETA Meeting, University of L’Aquila.
6. 20 June 2023: *Mathematical and numerical modeling of axonal beading*, ECCOMAS Young Investigators Conference, University of Porto.
7. 17 May 2023: *Mathematical modelling of axon mechanics*, Seminar in Mathematical Physics, Università degli Studi di Padova.
8. 11 May 2023: *Active elasticity in axons*, Workshop “Applications of Linear and nonlinear Elasticity”, organized by the Catholic University of Sacred Heart, Brescia.
9. 4 Apr 2023: *Mechanotransduction in axons: Remodelling of the actin cortex*, British Applied Mathematics Colloquium, Bristol.
10. 4 July 2022: *From coronavirus infections to Alzheimer’s disease: Buckling of damaged axons*, 11th European Solid Mechanics Conference, NUI Galway.
11. 2 Dec 2021: *Mechanical instabilities in slender structures*, Industrial and Applied Mathematics Seminar, University of Oxford.
12. 30 Sept 2021: *Mathematical modeling of axonal beading: From coronavirus infections to Alzheimer’s disease*, Recent Advances in Mechanics and Mathematics of Materials, Università la Sapienza, Rome.
13. 23 Sept 2021: *Shape transitions in damaged axons*, INdAM Meeting: “Active Materials: from Mechanobiology to Smart Devices”, Cortona.
14. 7 Apr 2021: *Role of tissue surface tension in brain organoid morphogenesis*, British Applied Mathematics Colloquium, Glasgow.
15. 17 June 2020: *Mechanics of axisymmetric sheets of interlocking and slidable rods*,

Giornate Signorini, Università degli Studi di Perugia.

16. 14 May 2020: *Morphoelasticity of solid tumours*, webinar organized by the University of Glasgow.
17. 28 Jan 2020: *Morphogenesis of sulci in brain organoids*, Institut Jean Le Rond d’Alembert, Sorbonne Université, Paris.
18. 17 Sept 2019: *Spatially constrained growth triggers tumour vessel tortuosity*, XXIV AIMETA Conference, Università la Sapienza, Rome.
19. 3 Sept 2019: *Influence of mechanical stress on solid tumor growth*, Workshop “The Mechanics of Cell Aggregates: Experiments and Models”, Politecnico di Torino.
20. 7 June 2019: *Role of tissue surface tension in the morphogenesis of brain organoids*, Workshop “Maths from the Body II”, organized by the Catholic University of Sacred Heart, Venice
21. 26 Feb 2018: *On the modeling of muscle contraction*, The Mathematics of Mechanobiology and Cell Signaling, Mathematisches Forschungsinstitut Oberwolfach.
22. 23 Oct 2017: *Rayleigh-Taylor instability in elastic bilayers*, Université Pierre et Marie Curie, Paris.
23. 31 Aug 2017: *Chemo-mechanical feedback in solid tumor growth*, INdAM Meeting: “Mathematical Physics of Living Systems”, Cortona.

OTHER
PRESENTATIONS

1. 18 Jan 2024: *Mathematical modelling of brain tumour growth: model order reduction and patient-specific parameter estimation*, Workshop “Mathematics for Artificial Intelligence and Machine Learning”, Università Bocconi, Milano
2. 28 Aug 2023: *Mathematical modelling of brain tumour growth: reduced order modelling and parameter estimation*, Congress of the Italian Society of Applied and Industrial Mathematics, University of Basilicata.
3. 6 June 2023: *Tunable buckling of dielectric-elastomer spherical shells*, XXII International Conference on Waves and Stability in Continuous Media (WASCOM), Bari.
4. 12 Oct 2022: *Nucleation of cracks as an elastic instability*, Workshop *Modelling Cell and Tissue Biomechanics*, Laboratoire Jacques-Louis Lions, Sorbonne Université, Paris.
5. 17 June 2022: *Mathematical modelling of initially stressed materials*, XXIII Symposium on Trends in Applications of Mathematics to Mechanics, Catholic University of Sacred Heart, Brescia.
6. 2 Sept 2021: *From coronavirus infections to Alzheimer’s disease: Pearling of damaged axons*, Congress of the Italian Society of Applied and Industrial Mathematics, University of Parma.
7. 1 Sept 2020: *Innovative structures inspired by microorganism motility*, XLV Summer School on Mathematical Physics (GNFM – INdAM), Ravello.
8. 13 Sept 2018: *On the mathematical modelling of muscle contraction*, XLIII Summer School on Mathematical Physics (GNFM – INdAM), Ravello.
9. 05 July 2018: *On the stability of soft incompressible spheres with residual stresses*, 10th European Solid Mechanics Conference, Bologna.
10. 29 June 2017: *Rayleigh-Taylor instability in soft elastic layers*, International Workshop on Modelling of Nonlinear Continua, Castro Urdiales.
11. 12 Sept 2016: *Chemo-mechanical feedback in solid tumor growth*, XLI Summer School on Mathematical Physics (GNFM – INdAM), Ravello.
12. 1 Sept 2016: *Chemo-mechanical feedback in solid tumor growth*, Workshop “Constitutive behaviour of soft tissues: connecting experimental and modelling perspectives”, University of Manchester, Manchester.
13. 23 Sept 2015: *A mathematical model of skeletal muscle tissue with damage due to aging*, XL Summer School on Mathematical Physics (GNFM – INdAM), Ravello.

ORGANIZING
ACTIVITY

- Co-organizer (together with C. Giverso, G. Lucci, G. Pozzi) of the mini-symposium *Mathematical modelling in biology* at the congress of the *Italian Society of Applied*

and *Industrial Mathematics* 2023, held at the University of Basilicata (28/8/2023 – 1/9/2023)

- Member of the organizing committee of the conference *MOX 20*.
- Co-organizer (together with V. Balbi) of the mini-symposium *Soft tissue biomechanics: From experiments to mathematical modelling* at the congress of the *Italian Society of Applied and Industrial Mathematics* 2020-21 held at the University of Parma (30/8/2021 – 3/9/2021)

REVIEWER

Reviewer for (alphabetic order)

- *AIMS Mathematics in Engineering*,
- *Computer Methods and Programs in Biomedicine*,
- *Continuum Mechanics and Thermodynamics*,
- *Extreme Mechanics Letters*,
- *International Journal of Engineering Science*,
- *International Journal of Non-Linear Mechanics*,
- *International Journal of Solids and Structures*,
- *Journal of Elasticity*,
- *Journal of Engineering Mathematics*,
- *Journal of Mechanics of Materials and Structures*
- *Journal of the Mechanics and Physics of Solids*,
- *Mathematics and Mechanics of Solids*,
- *Meccanica*,
- *Physical Review E*,
- *Physical Review Letters*,
- *Proceedings of the Royal Society A*,
- *Soft Matter*,

for a total of 42 reviews.

Reviewer for the *European Research Council* (Starting grant).

Reviewer for the *Human Frontier Science Program* research grants.

Reviewer for *Mathematical Reviews*.

SUPERVISED STUDENTS

Supervised master's students:

- F. Magni (Corso di Laurea Magistrale in Ingegneria Matematica, Politecnico di Milano, 2024), *A mathematical model of axonal beading based on the theory of active material surfaces*.
- A. Conti (Corso di Laurea Magistrale in Ingegneria Informatica, Politecnico di Milano, 2024), *Improving mathematical models of cancer by including resistance: A study on bladder cancer*.

Co-supervised master's students:

- V. Pederzoli (Corso di Laurea Magistrale in Ingegneria Matematica, Politecnico di Milano, 2024), *A mathematical model of brain atrophy in Alzheimer's disease*, supervisor: P. F. Antonietti, other co-supervisor: M. Corti.
- D. Cerrone (Corso di Laurea Magistrale in Ingegneria Matematica, Politecnico di Milano, 2023), *A Neural Network approach to Reduced Order Model of Glioblastoma Growth and its Neuroimaging-informed Estimation of Patient-Specific Parameters*, supervisor: P. Ciarletta, other co-supervisor: P. Zunino.
- G. Ewald (Master 2, Génie Mécanique et Matériaux, Ecole des Ponts ParisTech, 2022), *Mechanical instabilities in materials with softening*, co-supervisor: P. Ciarletta. Currently Ph.D. student at the Université Grenoble Alpes.

TEACHING EXPERIENCE

Lecturer

- **Rational mechanics**, Bachelor's Degree in Civil Engineering, Politecnico di Milano.
Academic year: 2021–2022, 2022–2023, 2023–24.
Number of students: ~40.
Language: English.

Teaching assistant

- **Rational mechanics**, Bachelor's Degree in Biomedical Engineering and Telecommunication Engineering, Politecnico di Milano.
Academic year: 2020–2021 (2 courses).
Number of students: ~150.
Language: Italian.
- **Calculus II**, Bachelor's Degree in Electronic and Computer Engineering, Università di Trieste.
Academic year: 2019–2020.
Number of students: ~100.
Language: Italian.
- **Linear algebra and geometry**, Bachelor's Degree in Naval Architecture and Marine Engineering, Università di Trieste.
Academic year: 2019–2020.
Number of students: ~100.
Language: Italian.
- **Mathematical and physical modeling in engineering**, Master's Degree in Mathematical Engineering, Politecnico di Milano.
Academic years: 2015–2016, 2016–2017, 2017–2018.
Number of students: ~25.
Language: English.
- **Calculus I**, Bachelor's degree in Civil Engineering, Politecnico di Milano.
Academic year: 2016–2017.
Number of students: ~150.
Language: Italian.

RESEARCH FUNDING: PI OR LOCAL COORDINATOR

- IDEA League Fellowship: *Mathematical and computational modelling of fracture propagation in soft matter*.
 - Role: PI.
 - Amount: 15 k€.
- PRIN 2022: *Mathematical models for viscoelastic biological matter*
 - Role: local coordinator.
 - PI: G. G. Giusteri.
 - Amount: 187 k€.
- INdAM – GNFM project 2021: *Transizioni di forma nella materia biologica e attiva* (Shape transitions in biological and active matter).
 - Role: PI.
 - Amount: 4 k€.

PARTICIPATION TO RESEARCH PROJECTS

- INdAM – GNFM project 2023: *Rimodellamento in materiali anisotropi e attivi* (Remodelling in anisotropic and active materials)
 - Role: member.
 - P.I.: G. Lucci.
 - Amount: 2.5 k€.
- CNRS project "Modelling cell and tissue biomechanics" (MOCETIBI)

- Role: member.
- P.I.: L. Almeida
- Amount: 40 k€.
- PRIN 2020: *Mathematics for Industry 4.0*
 - Role: member.
 - P.I.: P. Ciarletta.
 - Amount: 0.48 M€.
- Regione Lombardia *NEWMED* project: Materials and methods for personalized and precision medicine
 - Role: member.
 - P.I.: D. Polli.
 - Amount: 3.3 M€.
- *MicroMotility* ERC Advanced Grant.
 - Role: member.
 - P.I. A. De Simone.
 - Amount: 1.3 M€.
- PRIN 2017: *Mathematics of active materials: from mechanobiology to smart device*
 - Role: member.
 - P.I.: L. Preziosi.
 - Amount: 0.42 M€.
- INdAM – GNFM project 2017: *Evoluzione e Controllo della Forma nei Materiali Attivi* (Shape control in active material).
 - Role: member.
 - P.I.: A. Lucantonio.
 - Amount: 2.5 k€.
- INdAM – GNFM project 2016: *Fenomeni di frattura e instabilità nei Materiali Soffici Attivi* (Fracture and instability phenomena in soft active materials).
 - Role: member.
 - P.I.: G. Noselli.
 - Amount: 5 k€.

INSTITUTIONAL
ACTIVITY

- Since Sept 2021: member of the Programme Board of Civil Engineering at the Politecnico di Milano.

RECRUITMENT

- Feb 2024: participation to the committee for the selection of teaching assistants for the courses of Mathematical Physics at the Politecnico di Milano.
- Oct 2022: participation to the committee for the selection of a postdoc in Mathematical Physics at the Politecnico di Milano.
- Sept 2022: participation to the committee for the selection of tutors for the bachelor's degree in Civil Engineering at the Politecnico di Milano.
- Jan 2022: participation to the committee for the selection of teaching assistants for the courses of Mathematical Physics at the Politecnico di Milano.
- Oct 2021: participation to the committee for the selection of a postdoc in Mathematical Physics at the Politecnico di Milano.

- MEMBERSHIPS
- 2016–present: member of the *Gruppo Nazionale di Fisica Matematica* of the *Istituto Nazionale di Alta Matematica* (National Institute of Higher Mathematics).
 - 2019–present: member of the *Italian Association of Theoretical and Applied Mechanics* (AIMETA)
 - 2021–present: member of the *Italian Society of Applied and Industrial Mathematics* (SIMAI).

- POPULARIZATION – ARTICLES
1. D. Riccobelli. Un'introduzione ai modelli matematici. *Nuova Secondaria*, 9, 2016

- POPULARIZATION – OTHER ACTIVITIES
- Participation to the “SISSA for schools” program (2019).
 - Participation to the “Meet me tonight – Incontri con la scienza” (2017–2018).
 - Tutor for high school students in preparation for the Italian Mathematical Olympiad (2014–2018).

Milano, April 15, 2024