

Marcello Vasta

Professor of Structural and Solid Mechanics

Academic Position

- Full Professor of Structural and Solid Mechanics
- University "G. D'Annunzio" of Chieti and Pescara
- Joint appointment with Campus Bio-Medico University of Rome (since 2025).

Research Profile

Marcello Vasta is Full Professor of Structural and Solid Mechanics with more than thirty years of research experience in computational mechanics, stochastic dynamics, biomechanics, and constitutive modeling of complex materials.

His research spans structural reliability, nonlinear dynamics, structural health monitoring, multiscale mechanics, and biomechanics of soft biological tissues. He has developed innovative constitutive models for fiber-reinforced biological materials, cardiac tissue electromechanics, corneal biomechanics, and bio-inspired materials, integrating theoretical, computational, and probabilistic approaches.

His scientific activity has resulted in more than 120 publications, over 1,800 citations, and an h-index of 24 (Google Scholar, March 2025).

Main Research Areas

Computational and Structural Mechanics

- Nonlinear mechanics of solids and structures.
- Structural dynamics and stochastic mechanics.
- Structural reliability and uncertainty quantification.
- Wind engineering and aeroelasticity.
- Structural health monitoring and damage identification.

Biomechanics and Mechanobiology

- Constitutive modeling of biological tissues.
- Fiber-reinforced soft tissue mechanics.
- Cardiac tissue electromechanics.
- Corneal biomechanics and keratoconus modeling.
- Growth, remodeling, and collagen microstructure characterization.
- Biomechanics-based design of biomedical devices and implants.

Advanced Materials

- Bio-inspired materials.
- Composite materials.
- Multiscale and homogenization methods.
- Mechanical metamaterials.

International Research Experience

University of Sussex, United Kingdom

Marie Curie Fellow and Research Associate (1996–2000).

Research activities in stochastic structural dynamics, nonlinear system identification, and probabilistic mechanics under the supervision of Prof. J.B. Roberts.

University of Innsbruck, Austria

Assistant Professor (1997).

Research activities in engineering mechanics and structural dynamics.

University of Illinois at Urbana-Champaign, USA

Visiting Professor (2004).

Research collaboration in nonlinear dynamics and computational mechanics.

University of Minho, Portugal

Visiting Professor (2006).

Research collaboration in structural monitoring and masonry structures.

Graz University of Technology, Austria

Visiting Professor (2016).

Research collaboration in biomechanics and constitutive modeling of biological tissues.

Leadership and Scientific Responsibilities

Department Leadership

- Director, Department of Engineering and Geology (INGEO), University of Chieti–Pescara (2020–present).

National Scientific Evaluation

- Member of the National Scientific Qualification Committee (ASN), Structural Mechanics (ICAR/08), 2020–2023.

Current and Previous Membership in Doctoral Boards

Member of doctoral boards in:

- Engineering Science.
- National PhD Program in Artificial Intelligence.

Competitive Research Funding

International Projects

- Marie Curie Fellowship – Higher Order Spectral Analysis for Structural System Identification.
- EC Human Capital and Mobility Programme – Stochastic Mechanics in Structural and Mechanical Engineering.

National Projects

- Multiple PRIN projects (2001–2022).
- Principal Investigator of the local research unit in PRIN 2022 COB-IDEA.
- Participant in PRIN-PNRR 2022 Mechavers.
- Supervisor of industrial and international doctoral projects.

Selected Scientific Contributions

- Statistical constitutive modeling of fiber-reinforced biological tissues.
- Electromechanical models of active cardiac tissue.
- Corneal biomechanics and collagen microstructure modeling.
- Structural health monitoring through spectral-based damage identification.
- Stochastic dynamics and reliability of structural systems.
- Numerical homogenization and optimization of biomedical implants.

Selected Recent Publications in Biomechanics

1. Gizzi, A., Cyron, C.J., Falcinelli, C., Vasta, M. *Evolution of fiber distributions in homogenized constrained mixture models of soft tissue growth and remodeling: Uniaxial loading.* Journal of the Mechanics and Physics of Solids, 183, 2024.
2. De Bellis, M.L., Vasta, M., Gizzi, A., Pandolfi, A. *Modeling the deterioration of the stiffness and of the collagen fibril distribution in a discrete model of the cornea microstructure.* International Journal of Non-Linear Mechanics, 163, 2024.
3. Falcinelli, C., Valente, F., Vasta, M., Traini, T. *Finite element analysis in implant dentistry: State of the art and future directions.* Dental Materials, 39(6), 539–556, 2023.
4. Pandolfi, A., De Bellis, M.L., Gizzi, A., Vasta, M. *Modeling the degeneration of the collagen architecture in a microstructural model of the human cornea.* Mathematics and Mechanics of Solids, 28(1), 196–207, 2023.
5. Gizzi, A., Vasta, M., Pandolfi, A. *Diffusion-based degeneration of the collagen reinforcement in the pathologic human cornea.* Journal of Engineering Mathematics, 127(1), 3, 2021.

Academic Biography

Prof. Marcello Vasta is Full Professor of Structural Mechanics at the University “G. d’Annunzio” of Chieti–Pescara and Director of the Department of Engineering and Geology (INGEO). Since 2025, he also holds a joint appointment with Campus Bio-Medico University of Rome. He received his Ph.D. in Structural and Geotechnical Engineering from the University of Palermo in 1995 and has over thirty years of experience in computational mechanics, structural dynamics, biomechanics, and stochastic mechanics. Throughout his career, he has held academic positions at the University of L’Aquila, the University of Chieti–Pescara, and Campus Bio-Medico University of Rome. His international research experience includes appointments as Marie Curie Fellow at the University of Sussex (UK), Assistant Professor at the University of Innsbruck (Austria), and Visiting Professor at the University of Illinois at Urbana-Champaign (USA), the University of Minho (Portugal), and Graz University of Technology (Austria). He has served on national academic evaluation committees, doctoral boards, and the National Scientific Qualification Committee for Structural Mechanics. His scientific output includes more than 120 publications, over 1,700 citations, and an h-index of 24 (Google Scholar, 2025).

Areas of Expertise

Prof. Vasta’s research expertise spans computational mechanics, structural mechanics, biomechanics, and stochastic dynamics. His work focuses on the development of analytical and numerical models for nonlinear materials and structures, uncertainty quantification, structural reliability, and structural health monitoring. In biomechanics, he has made significant contributions to the constitutive modeling of soft biological tissues, particularly fiber-reinforced materials characterized by distributed collagen architectures. His research includes electromechanical models of cardiac tissue, corneal biomechanics under physiological and pathological conditions, mechanobiology, tissue growth and remodeling, and multiscale modeling approaches. Additional expertise includes finite element analysis, numerical homogenization, bio-inspired materials, computational biomechanics, and optimization methods for biomedical devices and implants. He has extensive experience in integrating probabilistic, statistical, and multiscale methodologies into constitutive modeling frameworks for both engineering and biological applications.

Ongoing Research Projects

PRIN 2022 – COB-IDEA

Composite and Bio-Inspired Materials Design for Engineering Applications

Principal Investigator of the local research unit at the University of Chieti–Pescara. The project aims to develop innovative computational and theoretical methodologies for the design and optimization of advanced composite and bio-inspired materials. Research activities focus on multiscale modeling, constitutive characterization, homogenization techniques, and the identification of structure–property relationships inspired by biological systems. The project seeks to establish design strategies for high-performance materials with enhanced mechanical functionalities and tailored microstructures.

PRIN-PNRR 2022 – MECHAUVERS

Mechanics for the Metaverse (Mechavers)

Member of the local research unit coordinated by the University of Naples Federico II. The project investigates advanced computational mechanics methodologies for virtual and digital environments, integrating numerical simulation, multiscale modeling, and digital representations of physical systems. Activities include the development of computational tools capable of bridging physical and virtual domains, with applications ranging from advanced materials and structures to biomedical systems and digital twins