Curriculum vitae di *MARCO MINIACI*

Sottosettori ERC primari (max 3): PE11_13 Metamaterials engineering, PE8_3 Civil engineering, architecture, offshore construction, lightweight construction, geotechnics, PE8_4 - Computational engineering

- **PERSONAL DETAILS**

Family name, First name: Miniaci Marco

Birthdate: 28/05/1986

Researcher unique identifier(s): ORCID ID: 0000-0002-6830-3548, Scopus ID: 35581644400

URL for web site: https://sites.google.com/site/marcominiaciportfolio/

- **EDUCATION AND KEY QUALIFICATIONS**

01.01.2011 – 31.12.2013: Philosophiæ Doctor **(Ph.D.)** in "*Civil & Environmental Engineering"*, Department of Structural Mechanics, University of Bologna, Italy. Dissertation date: 19.05.2014.
Dissertation title: « *Behaviour and applications of elastic waves in structures and metamaterials* ».
Grade: 5/5.

19.09.2008 – 23.07.2010: **Master's degree** in "*Civil Engineering"*, Department of Civil, Chemical, Environmental & Materials Engineering, University of Bologna, Italy. Dissertation date: 23.07.2010.
Dissertation title: « *Characterization of mechanical parameters using guided waves* ».
Grade: 110/110 with honours.

20.09.2005 – 25.07.2008: **Bachelor's degree** in "*Civil Engineering"*, Department of Civil, Chemical, Environmental & Materials Engineering, University of Bologna, Italy. Dissertation date: 25.07.2010.
Dissertation title: « *Problems of wave propagation in continuous media* ».
Grade: 110/110 with honours.

- **CURRENT POSITION**

18.06.2025 – now: **Full Professor** at Politecnico di Torino within the Department of Structural, Geotechnical and Building Engineering. **Main responsibilities**: (i) Teaching structural mechanics; (ii) performing research in *wave dynamics*, *periodic structures,* and *metamaterials* in airborne, elastic, and underwater environment (involving theoretical, numerical, and experimental approaches).

- **PREVIOUS POSITIONS** – *cf. to the next point « fellowships » for the positions held between 2015 – 2018.*

01.01.2020 – 17.06.2025: **Researcher** at the French National Centre for Scientific Research (CNRS), within the Institute of Electronics, Microelectronics and Nanotechnology (IEMN), Villeneuve D'Ascq, France.

01.01.2018 – 30.06.2018: **Post-doctoral researcher** at the School of Aerospace Engineering – Georgia Institute of Technology – Atlanta, United States.

01.12.2014 – 30.11.2015: **Post-doctoral researcher** at the Dept. of Physics, University of Turin – Turin, Italy.

- **FELLOWSHIPS**

01.07.2018 – 31.12.2019: **Post-doctoral** researcher through the funded project **Co-fund Marie–Skłodowska Curie Fellowship** (GA No. 754364) at the Laboratory of Acoustics / Noise Control – Swiss Federal Laboratories for Materials Science and Technology (Empa) – Dubendorf, Switzerland. **Project submitted** and **run**: BIMEWAVES – *Bio-inspired hierarchical metamaterials for multi-scale elastic wave manipulation*.

01.12.2015 – 30.11.2017: Individual Marie–Skłodowska Curie fellow at the Laboratory of Waves / Complex Media, UMR 6294 of the French National Centre for Scientific Research (CNRS–LOMC) – Le Havre, France. **Project submitted** and **run**: HARPOCRATES – *Smart Phononic Cristals for Aircraft Noise Reduction* (GA No. 658483).

01.03.2013 – 31.08.2013: **Spinner fellow** (No. 271/12) at the Institute of Fluid-Flow Machinery, Polish Academy of Science – Gdańsk, Poland. **Project submitted** and **run**: MCCM – *Mechanical Characterization of Composite Structures*.

- **RESEARCH ACHIEVEMENTS AND PER RECOGNITION**

Bibliometric indicators (WoS/Scopus). According to Scopus records[1], the candidate has published **81 peer-reviewed publications**, with **2820 citations** and an **h-index of 27**. His publication record includes articles in multidisciplinary and leading specialized journals such as *Nature Communications, International Journal of Solids and Structures, International Journal of Mechanical Sciences, Physical Review Letters*, *Physical Review X*, *Physical Review Applied*, *npj Acoustics*, *Journal of Sound and Vibration*, *Soil Dynamics and Earthquake Engineering*, …

Selected research outputs (structured by scientific contribution). The candidate has strongly contributed to the field of mechanical metamaterials and wave physics in structured media through a coherent set of contributions spanning fundamental concepts, experimental validation, and real-scale applications. The selected research outputs are reported below, organized by scientific themes to highlight the progression and impact of these contributions.

(i) Large-scale metamaterials for the mitigation of ground borne vibrations

This pioneering work was among the first establishing the extension of metamaterial concepts to long-wavelength regimes for the mitigation of ground-borne vibrations, demonstrating that structural architecture can effectively act as a constitutive parameter for wave control across scales.

[A1][2] Miniaci, M. et al. *Large-scale mechanical metamaterials as seismic shields.* New Journal of Physics 18, 083041 (2016).

Demonstrated that subwavelength architected structures can be upscaled to control seismic waves, enabling metamaterial concepts in civil and geophysical engineering.

Role: Lead author; conception, modelling, analysis, and writing.

(ii) Bio-inspired and hierarchical metamaterials

These works introduced the concepts of bio-inspiration and hierarchical organization of the unit cell to achieve broadband and multi-scale wave attenuation.

[A2] Mazzotti, M. et al. *Bio-inspired non-self-similar hierarchical elastic metamaterials*. International Journal of Mechanical Sciences 241, 107915 (2023).

Demonstrated that tailored hierarchical designs enable the activation of multiple wave attenuation mechanisms (e.g. Bragg scattering, local resonance, inertial amplification), leading to broadband and highly attenuative band gaps across frequency scales.

Role: Last and corresponding author, conception, modelling, analysis, supervision.

[A3] Miniaci, M. et al. *Design and fabrication of bioinspired hierarchical dissipative elastic metamaterials.* Physical Review Applied 10, 024012 (2018).

Introduced bio-inspired hierarchy as a strategy for broadband wave attenuation.

Role: Lead author; conception, modelling, experiments, and writing.

(iii) Topological and robust wave phenomena

These contributions positioned the candidate among early contributors to topological mechanics in continuous elastic systems.

[A4] Miniaci, M. et al. *Experimental observation of topologically protected helical edge modes in patterned elastic plates.* Physical Review X 8, 031074 (2018).

Landmark experimental demonstration of topologically protected wave propagation in elastic continua.

Role: Lead and corresponding author; conception, modelling, experiments, and writing.

[A5] Miniaci, M. et al. *Valley-based splitting of topologically protected helical waves in elastic plates.* Physical Review B 100, 024304 (2019).

Extended topological wave control to valley-dependent transport and wave splitting.

Role: Lead and corresponding author; conception, theoretical and numerical development, measures.

[1] These data refer to the 24th of April 2026.

[2] "A" indicates "Article".

(iv) Nonlinear wave control and ultrasensitive detection

These works introduced a paradigm in which structured media amplify weak nonlinearities, enabling ultrasensitive sensing and wave manipulation.

[A6] Miniaci, M. et al. *Proof of concept for an ultrasensitive technique to detect and localize sources of elastic nonlinearity using phononic crystals.* Physical Review Letters 118, 214301 (2017).

Introduced an ultrasensitive detection strategy combining nonlinear wave mechanics and phononic crystals.

Role: Lead author; conception, modelling, experiments, and data analysis.

(v) Advanced and tunable metamaterial concepts

These works demonstrate advanced design strategies, including novel architectural degrees of freedom and active tunability.

[A7] Bergamini, A.; Miniaci, M. et al. *Tacticity in chiral phononic crystals.* Nature Communications 10, 4525 (2019).

Introduced tacticity as a novel architectural degree of freedom for tailoring dynamic responses.

Role: Co-first author and corresponding author; conception, modelling, and interpretation.

[A8] Gliozzi, A.S. et al. *Tunable photo-responsive elastic metamaterials.* Nature Communications 11, 2576 (2020).

Demonstrated actively tunable metamaterials enabled by photo-responsive mechanisms, opening routes toward adaptive and reconfigurable wave control.

Role: Co-author; contribution to modelling and interpretation, measures.

(vi) Technology transfer and engineering applications

[P9][3] Onorato, M. et al. (incl. Miniaci, M.) *Multi-directional/multi-frequency waves attenuator device between two fluids of different density.* European Patent No. 3594488 (2021).

Demonstrates the translation of metamaterial-inspired concepts to wave attenuation at fluid interfaces, relevant for underwater and offshore engineering.

Role: Co-inventor; contribution to concept and modelling.

[P11] Bosia, F. et al. (incl. Miniaci, M.) *Acoustic metamaterial lining for MRI noise cancellation* (accepted).

Demonstrates the application of labyrinthine acoustic metamaterials to low-frequency noise reduction in MRI systems, enabling efficient broadband absorption within compact and minimally invasive structures.

Role: Co-inventor; contribution to concept, modelling, and wave-control design.

Overall significance

Taken together, these outputs demonstrate the candidate's capacity to advance knowledge across several interconnected areas of wave mechanics: deep-subwavelength control, topological protection, nonlinear wave sensing, hierarchical design, acoustic absorption, and large-scale vibration mitigation. They also show a coherent evolution from early-career lead-author contributions to senior scientific leadership, including supervision of younger researchers, experimental validation, field-scale implementation and technology-oriented outputs.

Peer recognition

The candidate has received significant recognition from the international scientific community in the fields of mechanical metamaterials, wave physics, and acoustics, as demonstrated by the following selected achievements:

- **PRIZES AND AWARDS**

Marie Skłodowska-Curie Actions Award (2020) – *Impact of MSCA on fellow's career development (Experienced Researchers category, Croatian Presidency of the Council of the EU)*.

[3] "P" indicates "Patent".

Significance: Highly selective European-level recognition highlighting the scientific and career impact of MSCA-funded research.

PEDR Prize for doctoral and research supervision excellence, CNRS (2020).
Significance: Award recognising excellence in supervision and mentoring within one of Europe's leading research institutions.

Industry 4.0 Prize, GiovedìScienza (2020).
Significance: National recognition for research with strong innovation and industrial impact.

Best Session Organizer Award, META 2025 (2025).
Significance: Recognition of leadership in organising high-impact international scientific events.

Best Paper Award, 6th International Building Physics Conference (2015).
Significance: Early-career recognition of research quality at international level.

- **COMPETITIVE FELLOWSHIPS AND RESEARCH LEADERSHIP**

ERC Starting Grant (2021) – Principal Investigator, POSEIDON (GA 101039576).
Budget: 1'482'750.00 €.
ERC-funded project focused on the mechanics of waves and advanced acoustic/elastic metamaterials, with applications in underwater noise mitigation.
Role: Principal Investigator; full responsibility for scientific vision, project execution, team leadership, and delivery of research objectives.

European Union NextGenerationEU (NRRP – Mission 4, Component 2, Investment 1.2) – Principal Investigator, DREAM (ERC2024_00001).
Budget: 999'980.80 €.
Nationally funded project awarded (ERC-related) aimed at advancing research on the design of resilient metamaterials.
Role: Principal Investigator; responsible for scientific coordination, project implementation, and achievement of research milestones.

Horizon Europe, CL4–2022–Resilience–01–10 – Project Coordinator, MAGNIFIC (GA 101091968).
Budget: 4'063'608.00 € (of which 839'063.00 € allocated to the coordinator).
Collaborative Horizon Europe project addressing advanced functional metamaterials for telecommunications (5G and satellite systems).
Role: Project Coordinator; overall responsibility for scientific direction, consortium management, coordination of international partners, and delivery of project objectives.

Marie Skłodowska-Curie Individual Fellowship (2014) – Principal Investigator, HARPOCRATES (GA 658483).
MSCA Individual Fellowship focused on acoustic/elastic wave propagation and metamaterials.
Role: Principal Investigator; independent research leadership, project design, and execution.

MSCA COFUND Fellowship (2018) – Principal Investigator, BIMEWAVES (GA 754364).
COFUND-supported research project on bio-inspired metamaterials and wave control at multiple length-scales.
Role: Principal Investigator; responsible for research development, interdisciplinary integration, and scientific dissemination.

- **INVITED PRESENTATIONS TO INTERNATIONALLY ESTABLISHED CONFERENCES / ADVANCED SCHOOLS**

Since 2015, the candidate has delivered 70+ talks at national and international meetings. Selected invited contributions include the World Congress on Computational Mechanics (Seoul, 2016), the International Conference on Metamaterials, Photonic Crystals and Plasmonics (Marseille, 2018), the Summer School on Wave Propagation in Complex and Microstructured Media (Cargèse, 2019), ICTAM (Milan, 2020/21), the

International Congress on Artificial Materials for Novel Wave Phenomena (New York, 2021) and the Euromech Colloquium 616 on the Unification of microsystems and metamaterials for new generation engineering solutions (Milan, 2022).

Selected keynote talks include those at the European Solid Mechanics Conference (Madrid, 2015), Multiple scattering in engineering and applied sciences workshop at the Isaac Newton Institute for Mathematical Sciences (Cambridge, 2023), Multiscale Innovative Materials and Structures workshop (Cetara, 2022) and the International Conference on Metamaterials, Photonic Crystals and Plasmonics (Malaga, 2025).

- **EDITORIAL AND REVIEWING ACTIVITIES**

Editorial Board Member, npj Acoustics (2024–present).

Reviewer for 50+ international journals, including top-tier venues (Nature, Science, Physical Review Letters, etc.).

IOP Trusted Reviewer Status (2020). Recognition of high-quality and consistent peer-review contributions.

- **SCIENTIFIC LEADERSHIP AND COMMUNITY ROLES**

Director of the CNRS GDR "ARCHI-META" (2022–2025). Leadership of a national research network coordinating activities in "Architectured Metamaterials" across France.

Expert evaluator and **reviewer** for major funding agencies, including the European Commission and several national research agencies in Europe and beyond.

Member of international scientific societies, including the European Acoustics Association (EAA), French Scociety of Acoustics (SFA), Phononics, and the International Association for Shell and Spatial Structures (IASS).

ADDITIONAL INFORMATION

Other contributions to the research community

The candidate has further demonstrated research leadership and scientific independence through the successful acquisition and coordination of other competitive international funding, as detailed below.

- **Horizon Europe MSCA Doctoral Network (2022)** – *METACMED* (GA 101119738), Beneficiary. Competitive European doctoral training network focusing on metamaterials for biomedical and energy applications, fostering interdisciplinary and intersectoral research.

  Role: Beneficiary; supervision of doctoral candidates and contribution to research and training activities.

  Total budget of the project: 2'185'783.20 €, Budget allocated to the candidate institution: 565'387.20 €.

- **FET-Open (H2020)** – *BOHEME* (GA 863179), Beneficiary and Work Package Leader.

  High-risk/high-gain European programme supporting disruptive research in bio-inspired metamaterials.

  Role: WP Leader; responsible for airborne acoustic measurements and dissemination activities.

  Total budget of the project: 3'226'250.00 €, Budget allocated to the candidate institution: 425'000.00 €.

Career breaks, diverse career paths and major life events

None