Andrea BACIGALUPO

Date of birth: September 21st, 1978
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5 MOST CITED PAPERS (updated on October 3rd, 2025)

A. Bacigalupo, L. Gambarotta, *Compos Struct,* **116**, 461–476, 2014.
A. Bacigalupo, L. Gambarotta, Int J Solids Struct, **83**, 126–141, 2016.
A. Bacigalupo, et al., *Smart Mater Struct*, **25**, 054009, 2016.
A. Bacigalupo, M.L. De Bellis, *Compos Struct*, **131**, 530–544, 2015.
A. Bacigalupo, L. Gambarotta, *Z Angew Math Mech*, **90**, 796–811, 2010.

CURRENT POSITION

2022–present: Full Professor of Solid and Structural Mechanics at the Department of Civil, Chemical, and Environmental Engineering of the University of Genoa.

PREVIOUS POSITIONS

2020-2022: Associate Professor of Solid and Structural Mechanics at the Department of Civil, Chemical, and Environmental Engineering of the University of Genoa.
2015–2019: Assistant Professor in Solid Mechanics and Mechanics of Materials at IMT – School for Advanced Studies, Lucca.
2014–2015: Research Associate, Department of Civil, Environmental, and Mechanical Engineering of the University of Trento, Italy.
2008–2013: Research Associate in the Department of Civil, Chemical, and Environmental Engineering of the University of Genoa, Italy.

EDUCATION

2008: Ph.D. Structural and Geotechnical Engineering at the University of Genoa, with full approval by the members of the Examination Committee.
2004: Full-Honors (110/110 cum laude) M. Sc Degree (5 years) in Civil in Structural, and Geotechnical Engineering at the University of Genoa, Italy.

RESEARCH PROJECT AND FUNDRAISING ACTIVITY

January 16, 2018 – Finanziamento annuale individuale delle attività base di ricerca (LEGGE 11 dicembre 2016, n. 232, art.1, commi 295-302).
June 8, 2018 – Progetto Giovani GNFM 2018: “Metamateriali gerarchici attivi”, co-investigators: Prof. A. Bacigalupo, Dr. M.L. De Bellis, and Dr. D. Misseroni.
January 1, 2021 – Project: “Superare la maschera: un approccio multidisciplinare integrato di neuroscienze cognitive e nanotecnologie”, Bando interno 2020 Università di Trento "Covid 19", co-investigators: Prof. F. Pavani, Dr. D. Bottari, Prof. A. Bacigalupo, and Prof. D. Misseroni.
Febrary 25, 2025 - financial support of the European Union – Next Generation EU, under the call PRIN 2022 of the Italian Minister of University and Research (MUR) – Project 202222LB37 (PE: Physical Sciences and Engineering): ‘‘Advanced Design of avant-garde ACTIVE microstructured materials via additive manufacturing (ADACTIVE)’’.

MEMBERSHIPS

Member of the Mathematical Physics National Group ("Gruppo Nazionale per la Fisica Matematica", GNFM) of the National Institute for Advanced Mathematics ("Istituto Nazionale di Alta Matematica", INdAM).

ORGANISATION OF SCIENTIFIC MEETINGS (a selection)

International Symposium on *Recent advances in mechanical modelling of microstructured composite materials and metamaterials* in the 14th World Congress in Computational Mechanics, Virtual Congress, January 11-15, 2021.
Special Session – *Recent advances in the mechanical modelling of composite materials and periodic structures* in mini-symposium Mechanics and Materials 2019, GMA–AIMETA 2019, September 15-19, Rome, Italy.
International Symposium on *Recent advances in the mechanical modelling of architected materials and periodic structures* in the International Conference on Nonlinear Solid Mechanics, 2019, June 16-19, Rome, Italy.
International Symposium on *Multiscale and Multiphysics Modelling for Complex Materials* in the 13th World Congress in Computational Mechanics, 2018, July 22-27, New York, USA.
Special Session – *Recent advances in the mechanical modelling of composite materials and periodic structures* in mini-symposium Mechanics and Materials 2017, GMA–AIMETA 2017, 4-7 September, Salerno, Italy.
GIMC-GMA 2016 – XXI National Conference of Computational Mechanics and the VIII Meeting of the AIMETA Materials Group, 27-29 June, Lucca, Italy.
Special Session – *Modelling of microstructured materials and metamaterials* in GIMC-GMA 2016 – XXI National Conference of Computational Mechanics and the VIII Meeting of the AIMETA Materials Group, 27-29 June, Lucca, Italy.
Special Session – *Non-local modelling of materials* in mini-symposium Mechanics and Materials 2015, GMA–AIMETA 2015, 14-17 September, Genoa, Italy.

EDITORIAL RESPONSIBILITIES AND REFEREE ACTIVITIES

Member of the editorial committee (Review Editor) of the Mechanics of Materials part of the Journals:
I) Frontiers in Materials (Electronic ISSN: 2296–8016);
II) Frontiers in Mechanical Engineering (Electronic ISSN: 2297–3079).
Co-editor: GIMC–GMA 2016, Book of Abstract, Tipolitografia Contini, Sesto Fiorentino (Italy), 2016, ISBN: 9791220013338.
Guest Associate Editor for Frontiers in Materials (Electronic ISSN: 2296–8016).
Referee of scientific papers for more than 50 international journals.

CO-EDITOR OF SPECIAL ISSUES OF INTERNATIONAL REFEREED JOURNALS

Special issue on "Cutting-Edge Metastructures: Micro-Architected and Active Metamaterials" in Frontiers in Materials, co-organized by: Dr. D. Misseroni, Prof. A. Bacigalupo, Dr. M.L. De Bellis, Prof. A. Movchan, Prof. G.H. Paolino.

RESEARCH FIELDS AND ACTIVITY

Andrea Bacigalupo's research activity is rooted in the fields of solid mechanics and materials science, where he has developed a broad and coherent program of investigation that bridges theoretical foundations with engineering applications. A central theme of his work is the development of asymptotic and variational-asymptotic homogenization methods, which provide rigorous mathematical tools for linking microstructural features to macroscopic behavior. His investigations extend to the multi-scale modeling of complex periodic and quasi-periodic

materials, with particular attention to multi-field coupling phenomena. Examples include auxetic, chiral, and anti-chiral lattice structures, thermo-piezoelectric systems, and elastic solids influenced by thermo-diffusion processes.
To address these challenges, he employs both local and non-local homogenization approaches, integrating asymptotic, variational-asymptotic, and computational techniques to capture phenomena that cannot be described by classical models alone. Another significant line of research is the study of acoustic wave dispersion in micro-structured solids, where he has shown how the micro-architecture critically influences the dynamic response and wave-filtering properties of these materials. In this context, he has also developed methods of high-frequency homogenization and continualization for periodic Cauchy continua and beam-lattice materials, providing a systematic framework for the analysis of complex band structures and the prediction of frequency band gaps.
His most recent contributions concern the optimal design of phononic crystals and acoustic metamaterials, targeting both passive and active wave-control strategies, and the development of innovative piezoelectric actuators with auxetic microstructures. This body of work demonstrates a clear ambition to translate theoretical advances into functional technologies for smart and adaptive materials.

20 SCIENTIFIC PUBLICATIONS (A SELECTION)

- A. Bacigalupo, L. Gambarotta, Second-gradient homogenization model for wave propagation in heterogeneous periodic media, *International Journal of Solids and Structures*, **51**, 1052–1065, 2014. ISSN 0020-7683, doi: 10.1016/j.ijsolstr.2013.12.001
- A. Bacigalupo, Second-order homogenization of periodic materials based on asymptotic approximation of the strain energy: formulation and validity limits, *Meccanica*, **49**(6), 1407-1425, 2014. ISSN 0025-6455, doi: 10.1007/s11012-014-9906-0
- A. Bacigalupo, L.Morini, A. Piccolroaz, Multiscale asymptotic homogenization analysis of thermo-diffusive composite materials, *International Journal of Solids and Structures*, **85**, 15-33, 2016. ISSN 0020-7683, doi: 10.1016/j.ijsolstr.2016.01.016
- A. Bacigalupo, L. Gambarotta, Simplified modelling of chiral lattice materials with local resonators, *International Journal of Solids and Structures*, **83**, 126-141, 2016. ISSN 0020-7683, doi: 10.1016/j.ijsolstr.2016.01.005
- A. Bacigalupo, M. Lepidi, High-frequency parametric approximation of the Floquet-Bloch spectrum for anti-tetrachiral materials, *International Journal of Solids and Structures*, **97**, 575-592, 2016. ISSN 0020-7683, doi: 10.1016/j.ijsolstr.2016.06.018
- A. Bacigalupo, L. Gambarotta, Wave propagation in non-centrosymmetric beam-lattices with lumped masses: discrete and micropolar modelling, *International Journal of Solids and Structures*, **118-119**, 128-145, 2017. ISSN 0020-7683, doi: 10.1016/j.ijsolstr.2017.04.010
- A. Bacigalupo, L. Gambarotta, Dispersive wave propagation in two-dimensional rigid periodic blocky materials with elastic interfaces, *Journal of the Mechanics and Physics of Solids*, **102**, 165-186, 2017. ISSN 0022-5096, doi: 10.1016/j.jmps.2017.02.006
- F. Fantoni, A. Bacigalupo, M. Paggi, Multi-field asymptotic homogenization of thermo-piezoelectric materials with periodic microstructure, *International Journal of Solids and Structures*, **120**, 31-56, 2017. ISSN 0020-7683, doi: 10.1016/j.ijsolstr.2017.04.009

- M. Lepidi, A. Bacigalupo, Multi-parametric sensitivity analysis of the band structure for tetrachiral acoustic metamaterials, *International Journal of Solids and Structures*, **136-137**, 186-202, 2018. ISSN 0020-7683, doi: 10.1016/j.ijsolstr.2017.12.014
- A. Bacigalupo, M. Lepidi, Acoustic wave polarization and energy flow in periodic beam lattice materials, *International Journal of Solids and Structures*, **147**, 183-203, 2018. ISSN 0020-7683, doi: 10.1016/j.ijsolstr.2018.05.025
- F. Fantoni, A. Bacigalupo, M. Paggi, Design of thermo-piezoelectric microstructured bending actuators via multi-field asymptotic homogenization, *International Journal of Mechanical Sciences*, **146-147**, 319-336, 2018. ISSN 0020-7403, doi: 10.1016/j.ijmecsci.2018.07.019
- R. Del Toro, A. Bacigalupo, M. Paggi, Characterization of wave propagation in periodic viscoelastic materials via asymptotic-variational homogenization, *International Journal of Solids and Structures,* **172**, 110-146, 2019. ISSN 0020-7683 doi: 10.1016/j.ijsolstr.2019.03.007
- A. Bacigalupo, L. Gambarotta, Generalized micropolar continualization of 1D beam lattices, *International Journal of Mechanical Sciences,* **155**, 554-570, 2019. ISSN 0020-7403, doi: 10.1016/j.ijmecsci.2019.02.018
- M. Lepidi, A. Bacigalupo, Wave propagation properties of one-dimensional acoustic metamaterials with nonlinear diatomic microstructure, *Nonlinear Dynamics,* **98**(4),2711-2735, 2019. ISSN 0924-090X, doi: 10.1007/s11071-019-05032-3
- M.L. De Bellis, A. Bacigalupo, G. Zavarise, Characterization of hybrid piezoelectric nanogenerators through asymptotic homogenization, *Computer Methods in Applied Mechanics and Engineering,* **355**, 1148-1186, 2019. ISSN 0045-7825, doi: 10.1016/j.cma.2019.06.040
- F. Fantoni, A. Bacigalupo, Wave propagation modeling in periodic elasto-thermo-diffusive materials via multifield asymptotic homogenization, *International Journal of Solids and Structures*, **196-197**, 99-128, 2020. ISSN 0020-7683, doi: 10.1016/j.ijsolstr.2020.03.024
- A. Bacigalupo, L. Gambarotta, Chiral two-dimensional periodic blocky materials with elastic interfaces: Auxetic and acoustic properties, *Extreme Mechanics Letters*, **39**, 100769, 2020. ISSN 2352-4316, doi: 10.1016/j.eml.2020.100769
- A. Bacigalupo, M.L. De Bellis, D. Misseroni, Design of tunable acoustic metamaterials with periodic piezoelectric microstructure, *Extreme Mechanics Letters*, **40**, 100977, 2020. ISSN 2352-4316, doi: 10.1016/j.eml.2020.100977
- A. Bacigalupo, L. Gambarotta, Identification of non-local continua for lattice-like materials, *International Journal of Engineering Science*, **159**, 103430, 2021. ISSN 0020-7225, doi: 10.1016/j.ijengsci.2020.103430
- A. Bacigalupo, G. Gnecco, M. Lepidi, L. Gambarotta, Computational design of innovative mechanical metafilters via adaptive surrogate-based optimization, *Computer Methods in Applied Mechanics and Engineering,* **375**, 113623, 2021. ISSN 0045-7825, doi: 10.1016/j.ijengsci.2020.103430.