

Konstantinos Karapiperis

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Curriculum Vitae

Personal details

Birth 02/08/1989

Gender Male

Citizenship Greek

Experience

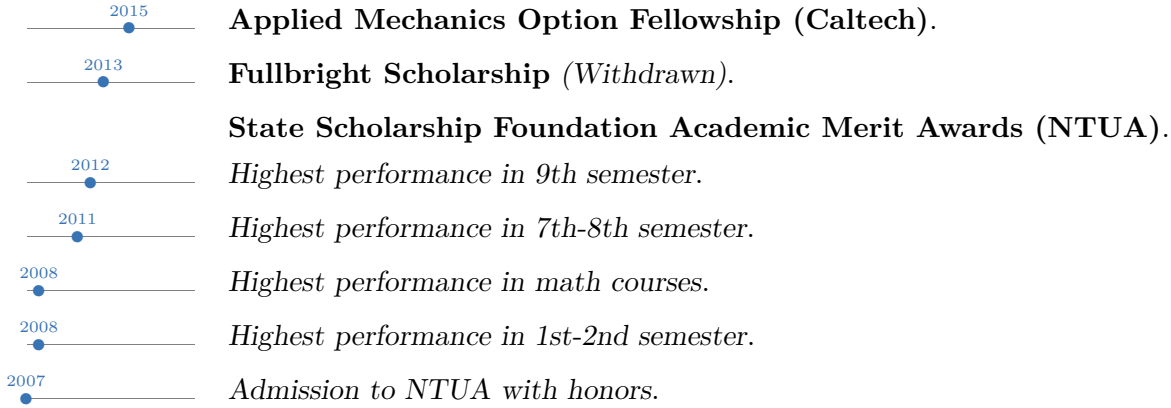
- 2024 (ongoing) Assistant Professor EPFL.
June
- 2023 – 2024 Lecturer ETH Zurich.
Feb. May
- 2021 – 2023 Marie Sklodowska-Curie Postdoctoral Fellow ETH Zurich.
Apr. Apr.
- 2021 – 2021 Visiting Postdoctoral Scholar Caltech.
Jan. Apr.
- 2015 – 2020 PhD Researcher/Teaching Assistant Caltech.
Sep. Dec.
- 2013 – 2015 Graduate Researcher/Teaching Assistant UC Davis.
Sep. May
- 2012 – 2013 Greek Army, Corps of Engineers.
Sep. June.
- 2011 – 2011 Archirodon N.V Athens, Greece.
Jun. Aug.
Construction Support Engineer

Education

- 2015 – 2020 California Institute of Technology, USA
Sep. Dec.
PhD in Applied Mechanics, GPA: 4.0/4.0.
Thesis: Multiscale, data-driven and nonlocal modeling of granular materials
Focus areas: Discrete/Finite Element Modeling, Multiscale data-driven computing, Nonlocal theories, Extraterrestrial applications of granular mechanics, Bonded particle mechanics
Minor in Applied and Computational Mathematics.
Focus areas: Optimization, Probability, Machine learning
- 2013 – 2015 University of California, Davis, USA
Sep. June
MSc in Civil Engineering, GPA: 4.0/4.0.
Thesis: Intrusive stochastic inelasticity of materials
Highlights: Development of nonlinear and non-Gaussian stochastic Finite Element framework, Formulation of Fokker-Planck-Kolmogorov theory for probabilistic elastoplasticity, Stochastic dynamic simulation for prediction of seismic ground motion
- 2007 – 2012 National Technical University of Athens, Greece
Sep. Nov.
Diploma in Civil Engineering (MSc equivalent), GPA: 9.0/10.
Thesis: Insight to the numerical modeling of foundations

Scholarships and Awards

- 2021 Marie Sklodowska-Curie Individual Fellowship.
- 2021 Postdoctoral Fellowship (ETH) (Waived).
- 2018 Hartley Fellowship (Caltech) (1 annual recipient in Mech. and Civil Engineering).



Publications

Under review - Preprints

- Apr. 2024 [1] **Karapiperis K.**, Widmer A., Kochmann D.M. "A conforming frictional beam contact model", *SSRN* (2024).
- May 2024 [2] Cui J., **Karapiperis K.**, Torgersrud O., Andò E., Viggiani G., Andrade J.E. "Deciphering Necking in Granular Materials: Micromechanical Insights into Sand Behavior During Cycles of Triaxial Compression and Extension", *SSRN* (2024).

Published

- Nov. 2023 [1] Zheng Li, **Karapiperis K.**, Kumar S., Kochmann D.M. "Unifying the design space and optimizing linear and nonlinear truss metamaterials by generative modeling", *Nature Communications* (2023).
- Nov. 2023 [2] Feldfogel S., **Karapiperis K.**, Andrade J.E., Kammer D.S. "A discretization-convergent level-set discrete element method using a continuum-based contact formulation", *International Journal for Numerical Methods in Engineering* (2023).
- Oct. 2023 [3] Feldfogel S., **Karapiperis K.**, Andrade J.E., Kammer D.S. "Failure of topologically interlocked structures—a Level-Set-DEM approach", *European Journal of Mechanics A* (2023).
- Oct. 2023 [4] **Karapiperis K.**, Radi K., Wang Z., Kochmann D.M. "A variational beam model for failure of cellular and truss-based architected materials", *Advanced Engineering Materials* (2023).
- June 2023 [5] **Karapiperis K.**, Kochmann D.M. "Prediction and control of fracture paths in disordered architected materials using graph neural networks", *Nature Communications Engineering* (2023).
- May 2023 [6] Jacinto U., Gorgogianni A., **Karapiperis K.**, Ortiz, M. Andrade J.E. "Data-driven breakage mechanics: Predicting the evolution of particle-size distribution in granular media", *Journal of the Mechanics and Physics of Solids* (2023).
- Dec. 2022 [7] Gorgogianni A., **Karapiperis K.**, Ortiz, M. Andrade J.E. "Adaptive Goal-oriented Data Sampling in Data-Driven Computational Mechanics", *Computer Methods in Applied Mechanics and Engineering* (2023).
- Dec. 2022 [8] Feldfogel S., **Karapiperis K.**, Andrade J.E., Kammer D.S. "Scaling, saturation, and upper bounds in the failure of topologically interlocked structures", *International Journal of Solids and Structures* (2023).

- Aug. 2022 [9] Buarque de Macedo R., Monfared S., **Karapiperis K.**, Andrade J.E. "What is shape? Characterizing particle morphology with genetic algorithms and deep generative models", *Granular Matter* (2022).
- July 2022 [10] **Karapiperis K.**, Monfared S., Buarque de Macedo R., Richardson S., Andrade J.E. "Stress transmission in entangled granular structures", *Granular Matter* (2022).
- Aug. 2021 [11] Li L., **Karapiperis K.**, Andrade J.E. "Emerging contact force heterogeneity in ordered soft granular media", *Mechanics of Materials* (2021).
- Aug. 2021 [12] **Karapiperis K.**, Ortiz M., Andrade J.E. "Data-Driven Nonlocal Mechanics: Discovering the Internal Length Scales of Materials", *Computer Methods in Applied Mechanics and Engineering* (2021).
- Aug. 2020 [13] **Karapiperis K.**, Stainier L., Ortiz M., Andrade J.E. "Data-Driven Multiscale Modeling in Mechanics", *Journal of the Mechanics and Physics of Solids* (2020).
- Aug. 2020 [14] **Karapiperis K.**, Andrade J.E. "Nonlocality in Granular Complex Networks: Linking Topology, Kinematics and Forces", *Extreme Mechanics Letters* (2020).
- July 2020 [15] Harmon J., **Karapiperis K.**, Li L., Moreland, S., Andrade J.E. "Particle Bonding within the Level Set Discrete Element Method for Modeling Connected Granular Media", *Computer Methods in Applied Mechanics and Engineering* (2020).
- July 2020 [16] **Karapiperis K.**, Harmon J., Andò E., Viggiani G., Andrade J.E. "Investigating the Incremental Behavior of Granular Materials with the Level-Set Discrete Element Method", *Journal of the Mechanics and Physics of Solids* (2020).
- May 2020 [17] Bhattacharya D., Kawamoto R., **Karapiperis K.**, Andrade J.E., Prashant A. "Mechanical Behaviour of Granular Media in Flexible Boundary Plane Strain conditions: Experiment and Level-Set Discrete Element Modelling", *Acta Geotechnica* (2020).
- Oct. 2019 [18] **Karapiperis K.**, Marshall, J.P, Andrade J.E. "Reduced gravity effects on the strength and flow of granular matter: DEM simulations vs experiments", *Journal of Geotechnical and Geoenvironmental Engineering* (2019).
- May 2016 [19] **Karapiperis K.**, Sett K., Kavvas M.L., Jeremic B. "Fokker-Planck Linearization for non-Gaussian Stochastic Elastoplastic Finite Elements", *Computer Methods in Applied Mechanics and Engineering* (2016).
- July 2015 [20] Zafeirakos T., Gerolymos N., **Karapiperis K.** "Generalized failure envelope for embedded foundations in cohesive soil: Static and dynamic loading", *Soil Dynamics and Earthquake Engineering* (2015).
- Nov. 2013 [21] **Karapiperis K.**, Gerolymos N. "Combined Loading of Caisson Foundations in Cohesive Soil: Finite Element versus Winkler Modeling", *Computers and Geotechnics* (2013).

Conferences and Seminars

Invited talks

- Mar 2024 **Karapiperis K.** "Recent advances in data-driven multiscale computational mechanics", *INRIA-TRIPOP, Grenoble, France, March 12, 2024.*
- Oct 2023 **Karapiperis K.** "Bridging physics-based and data-driven methods: Application to the mechanics of granular materials", *School of Applied Mathematics and Physical Sciences, Athens, Greece, Oct 23, 2023.*
- May 2023 **Karapiperis K.** "Bridging physics-based and data-driven modeling of granular materials", *EPFL ENAC Seminar Series, Lausanne, Switzerland, May 17, 2023.*

- May 2023 **Karapiperis K.** "Data-Driven modeling of geomaterials", *ALERT Doctoral School, Aussois, France, Sep 28, 2023.*
- June 2022 **Karapiperis K.** "Data-Driven Computing: Application to multiscale and nonlocal analysis of history-dependent materials", *Data-Driven Approach in Multiscale Analysis Workshop, Toulouse, France, June 20, 2022.*
- Dec. 2021 **Karapiperis K.** "Graph Learning for Design of Architected Networked Materials", *IMES Seminar Series, ETH Zurich, Zurich, Switzerland, Dec 10, 2021.*
- May 2019 **Karapiperis K.** "Lessons from virtual experiments on sands: Mapping the granular genome", *Knowles Solid Mechanics Symposium, Caltech, Pasadena, CA, May 17, 2019.*
- Sep. 2015 **Karapiperis K.** "Stochastic Plasticity and Dynamics", *Department of Civil Engineering Special Seminar, NTUA, Athens, Greece, Sep 7, 2015.*
- Conference presentations
- May 2024 Zheng Li, **Karapiperis K.**, Kumar S., Kochmann D.M. "Unifying the design space and optimizing linear and nonlinear truss metamaterials by generative modeling", *European Mechanics of Materials Conference, Madrid, Spain, May 29-31, 2024.*
- June 2023 **Karapiperis K.**, Kochmann D.M. "Contact-dominated architected materials", *VII ECCOMAS Young Investigators Conference, Porto, Portugal, June 19-21, 2023.*
- June 2023 Feldfogel S., **Karapiperis K.**, Andrade J.E., Kammer D.S. "The effects of material properties on the behavior and the failure of Topologically Interlocked Structures", *VII ECCOMAS Young Investigators Conference, Porto, Portugal, June 19-21, 2023.*
- Oct. 2022 **Karapiperis K.**, Kochmann D.M. "Architected Disordered Truss Metamaterials: Graph Learning meets Statistical Physics", *Society of Engineering Science, College Station, TX, USA, Oct 16-19, 2022.*
- Oct. 2022 **Karapiperis K.**, Gorgogianni A., Stainier L., Ortiz M., Andrade J.E. "Data-Driven Multiscale Mechanics: History-dependence, Nonlocality, Adaptive Sampling", *Society of Engineering Science, College Station, TX, USA, Oct 16-19, 2022.*
- July 2022 Gorgogianni A., **Karapiperis K.**, Stainier L., Ortiz M., Andrade J.E. "Adaptive Goal-oriented Phase Space Sampling in Data-Driven Computational Mechanics", *World Congress on Computational Mechanics, Yokohama, Japan, July 31- Aug 5, 2022.*
- July 2022 **Karapiperis K.**, Kochmann D.M. "Graph Neural Networks for Design of Disordered Truss Metamaterials", *European Solid Mechanics Conference, Galway, Ireland, July 3-8, 2022.*
- Apr. 2022 **Karapiperis K.**, Stainier L. Ortiz M., Andrade J.E. "Data-Driven Nonlocal Mechanics: Discovering the internal length scales of materials", *European Mechanics of Materials Conference, Oxford, UK, April 4-6, 2021.*
- Sept. 2021 Andrade J.E., **Karapiperis K.**, Stainier L., Ortiz M. "Data-Driven Multiscale Computing in Mechanics", *COMPLAS, Barcelona, Spain, September 7-9, 2021.*
- May 2021 **Karapiperis K.**, Stainier L, Ortiz M., Andrade J.E. "Data-Driven Modeling in Granular Mechanics", *Engineering Mechanics Institute Conference, New York, NY, May 25-28, 2021.*
- June 2020 Jostad H.P., Khoa H.D.V., **Karapiperis K.**, Andrade J.E. "Can LS-DEM be used to simulate cyclic behavior of sand?", *International Conference of the International Association for Computer Methods and Advances in Geomechanics, Turin, IT, June 30, 2020.*
- Oct. 2019 Andrade J.E., Harmon J., **Karapiperis K.** "New trends in computational geomechanics", *Society of Engineering Science, St. Louis, Mi, October 13-15, 2019.*

- June 2019 **Karapiperis K.**, Andrade J.E. "Incremental elastoplastic response of granular materials via virtual stress probing", *Engineering Mechanics Institute Conference, Pasadena, CA, June 18-21, 2019*.
- July 2018 **Karapiperis K.**, Andrade "The Elusive Granular Length Scale: Continuum vs Discrete", *World Congress of Computational Mechanics, New York, NY, July 22-27, 2018*.
- July 2018 Harmon J.H., Andrade J.E., **Karapiperis K.**, Viggiani G., Ando E., Liu L. "Micro-Inspired Continuum Modeling Using Virtual Experiments", *PEER Researcher's Workshop, Pacific Earthquake Engineering Research Center, UC Berkeley, July 08, 2018*.
- June 2018 **Karapiperis K.**, Andrade J.E. "Towards a physical description of granular length scales: Discrete and enhanced continuum juxtaposed", *Engineering Mechanics Institute Conference, Cambridge, MA, May 29-June 1, 2018*.
- June 2017 **Karapiperis K.**, Andrade, J.E, Marshall J.P. "Reduced gravity effects on the failure and flow of sand: DEM simulations vs experiments", *Engineering Mechanics Institute Conference, San Diego, CA, June 4-7, 2017*.
- Nov. 2015 **Karapiperis K.**, Watanabe K., Luo C., Abell J., Pisano F., Sett K., Jeremic B. "On Uncertainties and Seismic Ground Motions Modeling and Simulation", *6th International Conference on Earthquake Geotechnical Engineering, Christchurch, New Zealand, Nov 1-4, 2015*.
- May 2015 Jeremic B., Sett K., **Karapiperis K.**, Abell J. "Dynamics of Soils and Structures under Uncertainty", *1st International Conference on Uncertainty Quantification in Computational Sciences and Engineering, Crete, Greece, May 22-25, 2015*.
- May 2015 **Karapiperis K.**, Jeremic B., Sett K. "A meshless radial basis function solution to the Fokker-Planck-Kolmogorov Equations of Probabilistic Elastoplasticity", *1st International Conference on Uncertainty Quantification in Computational Sciences and Engineering, Crete, Greece, May 22-25, 2015*.
- Organized minisymposia
- Oct. 2023 **Karapiperis K.** "Micro-to-Macro Mechanics of Heterogeneous Solids and Granular Media", *Society of Engineering Science, Minneapolis, MI, USA, Oct 8-11, 2023*.
- Oct. 2022 **Karapiperis K.** "Micro-to-Macro Mechanics of Heterogeneous Solids and Granular Media", *Society of Engineering Science, College Station, TX, USA, Oct 16-19, 2022*.

Book chapters/ Theses

Data-Driven modeling of geomaterials *ALERT Doctoral School on Machine Learning in Geomechanics*.

Multiscale, data-driven and nonlocal modeling of granular materials *PhD Thesis (Caltech)*.

Intrusive Stochastic Inelasticity *MSc Thesis (UCD)*.

Insight to the Numerical Modeling of Caisson Foundations *Diploma thesis (NTUA)*.

Teaching

2023 – 2023
Feb. June **Multiscale Modeling**, *Co-instructor*, ETH Zurich.

2020 – 2020
Jan. Mar. **Static and Dynamic Failure of Brittle Solids and Interfaces**, *Teaching Assistant*, Caltech.

2019 – 2019 Sep. Dec.	Static and Dynamic Failure of Brittle Solids and Interfaces , <i>Teaching Assistant</i> , Caltech.
2019 – 2019 May June	Plasticity , <i>Teaching Assistant</i> , Caltech.
2018 – 2018 Sep. Dec.	Mechanics and Materials Aspects of Fracture , <i>Teaching Assistant</i> , Caltech.
2018 – 2018 Mar. June	Mechanics and Rheology of Fluid-Infiltrated Porous Media , <i>Teaching Assistant</i> , Caltech.
2014 – 2015 Nov. Dec.	Statics , <i>Teaching Assistant</i> , UC Davis.
2014 – 2014 Apr. June	Mechanics of Materials , <i>Teaching Assistant</i> , UC Davis.

PhD Students

2024 (ongoing) Mar.	Elias Pescialli , Jointly with Dennis Kochmann - ETH, <i>Project: Mechanics of intertwined architected materials.</i>
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MSc/BSc students

2024 – 2024 Mar. Aug.	Abhijeet Singh , MSc student - EPFL, <i>Project: Numerical investigation of fracture of quasiperiodic trusses.</i>
2024 – 2024 Mar. Aug.	Yves Brunner , MSc student - ETH, <i>Project: Experimental investigation of fracture of quasiperiodic trusses.</i>
2024 – 2024 Feb. June	Anastase Baltassis , MSc student - ETH, <i>Project: Experimental investigation of intertwined architected materials.</i>
2023 – 2024 July Apr.	Philippe Lothaller , MSc student - ETH, <i>Project: Graph Diffusion Models for Inverse Design of Mechanical Metamaterials.</i>
2023 – 2023 Apr. Sep.	Clement Rey , MSc student - Univ. Paris-Saclay, <i>Project: Rational design of the nonlinear response of interpenetrating truss lattices.</i>
2023 – 2023 Feb. Aug.	Adria Munoz , MSc student - ETH, <i>Project: Mechanics of architected woven lattices.</i>
2023 – 2023 Feb. July	Francesca Burlini , Bachelor student - ETH, <i>Project: Manufacturing and experimental investigation of interpenetrating truss lattices.</i>
2022 – 2023 August Jan.	Adrian Widmer , MSc student - ETH, <i>Project: Computational modeling of frictional metamaterials.</i>
2022 – 2022 Jan. Jul.	Johannes Aicher , MSc student - ETH, <i>Project: Reinforcement learning for design of architected lattice metamaterials.</i>
2021 – 2021 September Dec.	Adrien Mueller , MSc student - ETH, <i>Project: Development of a beam-to-beam self-contact algorithm.</i>
2021 – 2021 Jan. Nov.	Junhe Cui , Visiting Bachelor student - Caltech, <i>Project: Granular material behavior under cyclic triaxial loading.</i>
2019 – 2019 June Aug.	Eleni Blatsouka , Summer research fellow - Caltech, <i>Project: Stability of entangled granular structures under vibration.</i>
2019 – 2019 June Aug.	Sydney Richardson , Summer research fellow - Caltech, <i>Project: Angle of repose of 3D-printed granular structures.</i>
2017 – 2017 June Aug.	Debayan Bhattacharya , Visiting PhD student - Caltech, <i>Project: Instabilities in granular matter confined by flexible boundaries.</i>

Participation in research projects

National Science Foundation (U.S.A), 2020,
Project: Fabric and cyclic response of granular materials.
Jointly with Prof. J.E. Andrade

Marie Skłodowska-Curie Postdoctoral Fellowship Grant (ERC), 2021,
Project: Data-Driven Design of Disordered Materials.
Jointly with Prof. D.M. Kochmann

Service and Outreach

Reviewer for Nature Communications.

Reviewer for Int. J. Numer. Anal. Methods Geomech..

Reviewer for Acta Geotechnica.

Reviewer for Open Geomechanics.

Reviewer for Nano Letters.

Reviewer for Engineering With Computers.

Reviewer for Applied Sciences.

Reviewer for Geosciences.

Caltech March for Science Pasadena, CA public outreach event.

ERC Science is Wonderful Lectures to school students about science and engineering.

Computer Skills

Languages: C++, Python, Matlab, Mathematica.

Machine learning: Pytorch, Tensorflow.

Misc: AutoCAD, Linux, LaTeX, Git, MS Office.

Languages

Greek Native speaker.

English Excellent (C2).

German Fluent (C1).

Affiliations

American Society of Civil Engineers (ASCE).

American Physical Society (APS).

Society of Industrial and Applied Mathematics (SIAM).

Technical Chamber of Greece (TEE).