

Konstantinos Karapiperis

Leonhardstrasse 21
8092, Zurich, Switzerland
☎ +41 44 632 86 35
✉ kkarapiperis@ethz.ch
<https://kkarapiperis.github.io>

Curriculum Vitae

Personal details

Birth 02/08/1989
Gender Male
Citizenship Greek

Education

- 2015 – 2020**
Sep. Dec. **California Institute of Technology, USA**
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**
Sep. June **University of California, Davis, USA**
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**
Sep. Nov. **National Technical University of Athens, Greece**
Diploma in Civil Engineering (MSc equivalent), GPA: 9.0/10.
Thesis: Insight to the numerical modeling of foundations

Experience

- 2023** (ongoing) **Lecturer** *ETH Zurich.*
Feb.
- 2021 – 2023** **Marie Sklodowska-Curie Postdoctoral Fellow** *ETH Zurich.*
Apr. Feb.
- 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

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*).
- 2015** ● **Applied Mechanics Option Fellowship (Caltech).**

- 2013 **Fullbright Scholarship (Withdrawn).**
- 2012 **State Scholarship Foundation Academic Merit Awards (NTUA).**
Highest performance in 9th semester.
- 2011 *Highest performance in 7th-8th semester.*
- 2008 *Highest performance in math courses.*
- 2008 *Highest performance in 1st-2nd semester.*
- 2007 *Admission to NTUA with honors.*

Publications

Under review - Preprints

- Jan. 2023 [1] **Karapiperis K.**, Kochmann D.M. "Prediction and control of fracture paths in disordered architected materials using graph neural networks" (2023).
- Dec. 2022 [2] 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" (2022).
- Oct. 2022 [3] Feldfogel S., **Karapiperis K.**, Andrade J.E., Kammer D.S. "Failure of topologically interlocked structures—a Level-Set-DEM approach", *arXiv Soft Condensed Matter* (2022).
- Oct. 2022 [4] Feldfogel S., **Karapiperis K.**, Andrade J.E., Kammer D.S. "A discretization-convergent Level-Set-DEM", *arXiv Numerical Analysis* (2022).

Conditionally accepted

- Dec. 2022 [5] Gorgogianni A., **Karapiperis K.**, Ortiz, M. Andrade J.E. "Adaptive Goal-oriented Data Sampling in Data-Driven Computational Mechanics" (2022).
- Dec. 2022 [6] Feldfogel S., **Karapiperis K.**, Andrade J.E., Kammer D.S. "Scaling, saturation, and upper bounds in the failure of topologically interlocked structures", *arXiv Soft Condensed Matter* (2022).

Published

- Aug. 2022 [7] 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 [8] **Karapiperis K.**, Monfared S., Buarque de Macedo R., Richardson S, Andrade J.E. "Stress transmission in entangled granular structures", *Granular Matter* (2022).
- Aug. 2021 [9] Li L., **Karapiperis K.**, Andrade J.E. "Emerging contact force heterogeneity in ordered soft granular media", *Mechanics of Materials* (2021).
- Aug. 2021 [10] **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 [11] **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 [12] **Karapiperis K.**, Andrade J.E. "Nonlocality in Granular Complex Networks: Linking Topology, Kinematics and Forces", *Extreme Mechanics Letters* (2020).

- July 2020 [13] 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 [14] **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 [15] 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 [16] **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 [17] **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 [18] Zafeirakos Th, 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 [19] **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

- 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

- 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 and Ortiz M. "Data-Driven Multiscale Computing in Mechanics", *COMPLAS, Barcelona, Spain, September 7-9, 2021*.
- May 2021 **Karapiperis K.**, Stainier L, Ortiz M. and 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.** and 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. and **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. 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*.

Teaching

- 2023 (ongoing) **Multiscale Modeling**, *Co-instructor*, ETH Zurich.
Feb.
- 2020 – 2020 **Static and Dynamic Failure of Brittle Solids and Interfaces**, *Teaching Assistant*,
Jan. Mar. Caltech.
- 2019 – 2019 **Static and Dynamic Failure of Brittle Solids and Interfaces**, *Teaching Assistant*,
Sep. Dec. Caltech.
- 2019 – 2019 **Plasticity**, *Teaching Assistant*, Caltech.
May June
- 2018 – 2018 **Mechanics and Materials Aspects of Fracture**, *Teaching Assistant*, Caltech.
Sep. Dec.
- 2018 – 2018 **Mechanics and Rheology of Fluid-Infiltrated Porous Media**, *Teaching Assistant*,
Mar. June Caltech.
- 2014 – 2015 **Statics**, *Teaching Assistant*, UC Davis.
Nov. Dec.
- 2014 – 2014 **Mechanics of Materials**, *Teaching Assistant*, UC Davis.
Apr. June

Student Mentoring Experience

- 2022 (ongoing) **Kevin Kraschewski**, PhD student - ETH,
Dec. *Project: Quasicontinuum theory for truss lattices.*
- 2023 (ongoing) **Adria Munoz**, MSc student - ETH,
Feb. *Project: Mechanics of architected woven lattices.*
- 2023 (ongoing) **Francesca Burlini**, Bachelor student - ETH,
Feb. *Project: Manufacturing and experimental investigation of interpenetrating truss lattices.*
- 2022 – 2023 **Adrian Widmer**, MSc student - ETH,
August Jan. *Project: Computational modeling of frictional metamaterials.*
- 2022 – 2022 **Johannes Aicher**, MSc student - ETH,
Jan Jul *Project: Reinforcement learning for design of architected lattice metamaterials.*
- 2021 – 2021 **Adrien Mueller**, MSc student - ETH,
September Dec. *Project: Development of a beam-to-beam self-contact algorithm.*
- 2021 – 2021 **Junhe Cui**, Visiting Bachelor student - Caltech,
Jan Nov. *Project: Granular material behavior under cyclic triaxial loading.*
- 2019 – 2019 **Eleni Blatsouka**, Summer research fellow - Caltech,
June Aug. *Project: Stability of entangled granular structures under vibration.*
- 2019 – 2019 **Sydney Richardson**, Summer research fellow - Caltech,
June Aug. *Project: Angle of repose of 3D-printed granular structures.*
- 2017 – 2017 **Debayan Bhattacharya**, Visiting PhD student - Caltech,
June Aug. *Project: Instabilities in granular matter confined by flexible boundaries.*

Funding proposal experience

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

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

Service and Outreach

Reviewer for Nature Communications.

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: Proficiency of Cambridge/Michigan, ETS TOEFL/GRE).*

German *Fluent (C1: Zentrale Mittelstufenprüfung Zeugnis).*

Affiliations

American Society of Civil Engineers (ASCE).

American Physical Society (APS).

Society of Industrial and Applied Mathematics (SIAM).

Technical Chamber of Greece (TEE).

References

Prof. Dennis M. Kochmann *ETH Zürich, dmk@ethz.ch.*

Prof. Jose E. Andrade *Caltech, jandrade@caltech.edu.*

Prof. Ares J. Rosakis *Caltech, arosakis@caltech.edu.*

Prof. Gioacchino Viggiani *Caltech, cino.viggiani@3sr-grenoble.fr.*

Prof. Michael Ortiz *Caltech, ortiz@aero.caltech.edu.*