Gabriele Albertini, Ph.D.

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8/2022 *Assistant Professor of Structural Engineering*, The University of Nottingham

7/2021 – 7/2022 *Swiss National Science Foundation Postdoctoral Fellow*, Harvard University

Education

Cornell University

8/2016 – 5/2021 Doctor of Philosophy in Structural Engineering with minors in Computational Science and Engineering, and Solid Mechanics

École Polytechnique Fédérale de Lausanne – EPFL (Switzerland)

9/2014 – 6/2016 Master of Science in Civil Engineering

9/2011 – 6/2014 Bachelor of Science in Civil Engineering

University of New South Wales – UNSW Sydney (Australia)

8/2013 – 8/2014 Undergraduate Exchange Program in Civil Engineering

Research Experience

Harvard University

7/2021 – 7/2022 **Swiss National Science Foundation Postdoctoral Fellow**,
Advisor: Prof. Katia Bertoldi
Experimental study of soft tunable frictional interfaces. I developed a setup to directly observe the onset and propagation of instabilities along the frictional interface.

Cornell University

1/2016 – 5/2021 **Doctoral Research Assistant**, *Advisor:* Prof. David S. Kammer
Numerical and theoretical study of dynamic frictional ruptures. I developed dynamic rupture simulations that showed quantitative agreement with friction experiments. This demonstrated that frictional ruptures are classic dynamic cracks despite residual friction.

Eidgenössische Technische Hochschule – ETH Zürich (Switzerland)

9/2019 – 5/2021 **Visiting Researcher**, *Advisor:* Prof. David S. Kammer
Theoretical and numerical study of nucleation of slip fronts at frictional interfaces with random strength profiles. I showed that the effective strength increases with smaller correlation length.

Sorbonne Université (France)

9/2018 – 1/2019 **Visiting Researcher**, *Advisor:* Dr. Laurent Ponson
Experimental study of dynamic fracture of heterogeneous multi-material 3D-printed polymers. Using Digital Image Correlation, I showed that the crack instantaneously adjusts its speed as it enters a region with contrasting fracture energy.

École Polytechnique Fédérale de Lausanne – EPFL

9/2014 – 1/2015 **Master Student Researcher**, *Advisor:* Prof. Christian Louter
Experimental study of ultimate flexural strength of post-tensioned steel reinforced glass beams.

Research Interests

Solid Mechanics, Fracture Mechanics, Friction, Mechanics and Physics of Earthquakes, Mechanical Metamaterials, Heterogeneous Media, Nonlinear Physics, Non-equilibrium Statistical Mechanics, Scientific Computing, High Performance Computing, Artificial Intelligence

Grants & Awards

2020 Early Postdoc.Mobility Fellowship of the Swiss National Science Foundation for the duration of 18 months. Host institute: Bertoldi Lab at Harvard University. Starting date: June 2021.

2018 3rd Place for Oral Presentation. Tenth Annual Civil and Environmental Engineering Graduate Research Symposium. Cornell University.

2017 2nd Place for Oral Presentation. 9th Annual Civil and Environmental Engineering Graduate Research Symposium. Cornell University.

Publications

Refereed Journals

8 Albertini, G., Elbanna, A.E. and Kammer, D.S., (2021), "A three-dimensional hybrid finite element – spectral boundary integral method for modeling earthquakes in complex unbounded domains", **International Journal for Numerical Methods in Engineering** 122, 23, 6905-6923. https://doi.org/10.1002/nme.6816

7 Kammer, D.S., Albertini, G. and Ke, C.Y., (2021), "UGUCA: A spectral-boundary-integral method for modeling fracture and friction", **SoftwareX** 15, 100785. https://doi.org/10.1016/j.softx.2021.100785

6 Albertini, G., Lebihain, M., Hild, F. Ponson, L. and Kammer, D.S., (2021), "Effective Toughness of Heterogeneous Materials with Rate-Dependent Fracture Energy", **Physical Review Letters** 127, 035501. https://doi.org/10.1103/PhysRevLett.127.035501

5 Schär, S., Albertini, G. and Kammer, D. S., (2021), "Nucleation of frictional sliding by coalescence of microslip", **International Journal of Solids and Structures** 220, 111059. https://doi.org/10.1016/j.ijsolstr.2021.111059

4 Albertini, G., Karrer, S., Grigoriu, M. D. and Kammer, D. S., (2021), "Stochastic Properties of Static Friction", **Journal of the Mechanics and Physics of Solids** 147, 104242. https://doi.org/10.1016/j.jmps.2020.104242

3 Svetlizky, I.*, Albertini, G.*, Cohen, G., Kammer, D.S. and Fineberg, J., (2020), "Dynamic fields at the tip of sub-Rayleigh and supershear frictional rupture fronts", **Journal of the Mechanics and Physics of Solids** 137, 103826. https://doi.org/10.1016/j.jmps.2019.103826
*Equally contributing first authors

2 Ma, X., Hajarolasvadi, S., Albertini, G., Kammer, D.S., Elbanna, A.E., (2019), "Modeling Infinity: A Hybrid Finite Element - Spectral Boundary Integral Approach: Application to 3D dynamic earthquake fault ruptures", **International Journal for Numerical and Analytical Methods in Geomechanics** 43, 1, 317-338. https://doi.org/10.1002/nag.2865

1 Albertini, G., Kammer, D.S., (2017), "Off-fault heterogeneities promote supershear transition of dynamic mode II cracks", **Journal of Geophysical Research: Solid Earth** 122, 2017JB014301. https://doi.org/10.1002/2017JB014301

Work in Progress

1 Albertini, G., Ke, C.Y., G. McLaskey and Kammer, D.S., "Dynamic reactivation of laboratory-generated earthquakes", **under preparation**.

Presentations

Invited Seminars

2021 "Modeling of complex mechanical systems: fracture and friction", Department of Civil, Environmental, and Geo- Engineering, University of Minnesota, USA.

2021 "A Hybrid Finite Element–Spectral Boundary Integral Method for 3D Dynamic Fracture Simulation", Computational Mechanics of Building Materials, ETH Zurich, Switzerland.

Conferences & Workshops (presenter underlined)

2022 Albertini, G., Djellouli, A., Weitz, D.A., and Bertoldi, K., "Rubber friction: from steady sliding to stick slip and squeaking". *NEW.Mech.* May 6th, 2022, MIT, Cambridge, Massachusetts.

2022 Albertini, G., Djellouli, A., Weitz, D.A., and Bertoldi, K., "Rubber friction: from steady sliding to stick slip and squeaking". *American Physical Society March Meeting 2022.* March 14-18, 2022, Chicago, Illinois.

2021 Albertini, G., Schär, S., Karrer, S., Grigoriu, M.D., and Kammer, D.S., "Nucleation of frictional sliding". *17èmes Journées de la Matière Condensée.* August 24-27, 2021, virtual meeting.

2021 Kammer, D., Albertini, G., and Elbanna, A.E., "A Hybrid Finite Element–Spectral Boundary Integral Method for 3D Dynamic Fracture Simulation". *16th U.S. National Congress on Computational Mechanics (USNCCM 2021).* July 26–29, 2021, virtual meeting.

2021 Albertini, G., Lebihain, M., Hild, F. Ponson, L., and Kammer, D.S., "Dynamic fracture of heterogeneous materials". *MaP Graduate Symposium 2021. ETH Zurich.* June 14-15 2021, virtual meeting.

2020 Albertini, G., Lebihain, M., Hild, F. Ponson, L., and Kammer, D.S., "Effective toughness of heterogeneous materials with rate-dependent fracture energy". *Society of Engineering Science (SES) 57th Annual Technical Meeting.* September 29 - October 1, 2020, virtual meeting.

2019 Albertini, G., Lebihain, M., Hild, F. Ponson, L., and Kammer, D.S., "Effective toughness of periodic heterogeneous materials: the role of rate-dependent fracture energy". *Society of Engineering Science (SES) 56th Annual Technical Meeting.* October 13-15, 2019, St. Louis, Missouri.

2019 Svetlizky, I., Albertini, G., Cohen, G., Kammer, D.S., and Fineberg, J., "Dynamic fields at the tip of sub-Rayleigh and supershear frictional rupture fronts", *11th Annual Civil and Environmental Engineering Graduate Research Symposium. Cornell University.*

2018 Albertini, G., and Kammer, D.S., "Properties of Three Dimensional Supershear Mode II Ruptures", *Workshop: MEchanics and Physics of STrechable Objects (MEPHiSTO).* August 7-17, 2018, Cargese, France.

2018 Albertini, G., and Kammer, D.S., "Properties of Three Dimensional Supershear Mode II Ruptures", *18th U.S. National Congress for Theoretical and Applied Mechanics (USNCTAM).* June 4-9, 2018, Chicago, Illinois.

2018 Albertini, G., and Kammer, D.S., "Properties of Three Dimensional Supershear Mode II Ruptures", *Tenth Annual Civil and Environmental Engineering Graduate Research Symposium. Cornell University.*

2017 Albertini, G., and Kammer, D.S., "Propagation Speed Instability in Rapid Mode II Fracture in Heterogeneous Media", *Society of Engineering Science (SES) 54th Annual Technical Meeting.* July 25-28, 2017, Boston, Massachusetts.

2017 Albertini, G., and Kammer, D.S., "Dynamic shear crack propagation along frictional interfaces in heterogeneous elastic media, effects on supershear transition", *9th Annual Civil and Environmental Engineering Graduate Research Symposium. Cornell University.*

2016 Albertini, G. and Kammer, D.S., "Supershear transition of dynamic mode II fracture in heterogeneous elastic media", *Society of Engineering Science (SES) 53rd Annual Technical Meeting.* October 2-5, 2016, College Park, Maryland.

Publicly available open-source software

1 **uguca** (2021), Kammer, D.S., Albertini, G. and Ke, C.Y.
An open-source code for modeling fracture and friction with the spectral-boundary-integral method. https://gitlab.com/uguca (v1.0)

Mentoring

Semester Project (co-supervised with Prof. Katia Bertoldi)

Spring 2022 Florent Pollet, Applied Physics, Harvard University

Master Theses (co-supervised with Prof. David S. Kammer)

Spring 2017 Thibault Roch, Civil Engineering, Cornell University

Semester Projects (co-supervised with Prof. David S. Kammer)

Spring 2020 Styfen Schär, Civil Engineering, ETH Zürich

Fall 2019 Simon Karrer, Civil Engineering, ETH Zürich

Teaching Experience

Cornell University

Spring 2021 Differential Equations for Engineers (MATH 2930) – TA (66 students)
Taught weekly discussion sections and designed worksheets and in-class activities.

Fall 2020 Geotechnical Engineering for Energy, Environment and Civil Infrastructure (CEE 3410) – Teaching Assistant (TA) (37 students)
Designed and executed laboratory demonstrations. Homework and exam preparation and grading.

Spring 2020 Introduction to the Behavior of Steel Structures (CEE 4740) – TA (30 students)
Designed in-class activities and homework.

Spring 2019 Differential Equations for Engineers (MATH 2930) – TA (61 students)
Taught weekly discussion sections and designed worksheets and in-class activities.

Spring 2018 Differential Equations for Engineers (MATH 2930) – TA (101 students)
Taught weekly discussion sections and designed worksheets and in-class activities.

École Polytechnique Fédérale de Lausanne – EPFL

Fall 2015	Geothechincs and Rock Mechanics (Master) – TA Taught weekly discussion section
Spring 2013	Mathematics and Geometry (Undergraduate) – TA Taught weekly discussion section
Spring 2012	Mathematics and Geometry (Undergraduate) – TA Taught weekly discussion section

Industry Experience

Summer 2015	Engineer Intern at AF-Consult Switzerland AG. Project: Nant de Drance Pumped Storage Power Plant. Local site management.
Summer 2014	Engineer Intern at Repower AG. Project: Renovation of Silvaplana Hydro Power Plant. Feasibility Study.

University Service

Reviewer for:	International Journal of Solids and Structures
	Geophysical Research Letters
2017 – 2018	Treasurer of the Civil and Environmental Engineering Graduate Student Association (CEE GSA), Cornell University. Managed the yearly budget dedicated to events and activities organized by the CEE GSA, including the Graduate Student Research Symposium and academic talks by professors of the CEE department and invited speakers.

Professional Memberships

Society of Engineering Science (SES), American Physical Society (APS), Société Française de Physique, New England Complex Fluids

Languages

Italian (native), English (fluent), French (fluent) & German (fluent)

Technical Skills

Programming

Python, Matlab, C, C++, Fortran, MPI, OpenMP, Computer Vision, AI (PyTorch)

Numerical Modeling Methods

Finite Element Method, Spectral Boundary Integral Method, Cohesive Element Model for Fracture

Experimental Methods

Experimental Fracture Mechanics, Friction and Laboratory Earthquakes, Digital Image Correlation, Total Internal Reflection, Signal Processing, AI for Image Processing

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