

Exponent®
Engineering & Scientific Consulting

Eusef Abdelmalek-Lee, Ph.D.

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Professional Profile

Dr. Abdelmalek-Lee specializes in probabilistic risk assessment and natural hazards engineering. He has expertise in evaluating seismic risk for buildings and evaluating designs of structures subjected to extreme loads using nonlinear analyses methods and performance-based engineering methodologies. He has experience applying machine intelligence and statistical methods to remote sensing data to develop predictive models and perform efficient analyses of portfolios of structures and assets subjected to hazards such as seismic loads or other extreme events.

Prior to joining Exponent, Dr. Abdelmalek-Lee worked with ImageCat to develop seismic risk models for industrial facilities. He also worked at the Idaho National Laboratory (INL) in the Nuclear Science and Technology Division, where he developed a stochastic ground motion model to quantify seismic hazard. The new methods allowed for improved uncertainty quantification and included sensitivity analyses of nuclear facilities structures subjected to multiple seismic hazard levels.

Dr. Abdelmalek-Lee earned his PhD at the University of California, Los Angeles in Civil Engineering with a focus on Structural/Earthquake Engineering. During his Ph.D., Dr. Abdelmalek-Lee worked on an end-to-end seismic framework that implements design, analysis, and loss estimation for a suite of buildings to aid rapid post-event assessments. The framework modifies current methodologies, offering a machine learning alternative to traditional probabilistic seismic hazard analyses and enabling the use of strong motion data where computationally expensive nonlinear structural models are usually required.

Academic Credentials & Professional Honors

Ph.D., Civil Engineering, University of California, Los Angeles (UCLA), 2024

M.S., Civil Engineering, University of California, Los Angeles (UCLA), 2020

B.S., Civil Engineering, University of Florida, 2018

The National GEM Fellowship

UCLA Eugene V. Cota Robles Fellowship

Prior Experience

Risk Analyst Intern, ImageCat, 2023

Computational Mechanics Intern, Idaho National Laboratory, 2022

Structural Engineering Intern, Jacobs Engineering, 2018-2019

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Professional Affiliations

American Society of Civil Engineers (ASCE)

Earthquake Engineering Research Institute (EERI)

The Structural Engineers Association of Southern California (SEAOSC)

GEM Alumni Association (GEM)

Publications

Abdelmalek-Lee, E., Burton, H. A dual Kriging-XGBoost model for reconstructing building seismic responses using strong motion data. Bull Earthquake Eng (2023). https://doi.org/10.1007/s10518-023-01624-y

Abdelmalek-Lee, Eusef; Jain, Tricia; Madero, Sebastian; Sun, Han; Burton, Henry; Wallace, John (2022) "Relational Database for Building Strong Motion Recordings used for Seismic Impact Assessments." Earthquake Spectra. https://doi.org/10.17603/ds2-t5ar-n620 v1

Presentations

Abdelmalek-Lee, E., Jain, T., Madero, S.G., Sun, H., Burton, H., Wallace J. Development and Utilization of a Building Strong Motion Relational Database for Risk and Resilience Assessments. Poster Presentation, NHERI Computational Symposium, Los Angeles, CA 90095

Abdelmalek-Lee, E., Burton, H., and Dahal, L. Development and utilization of a building strong motion relational database for risk and resilience. 18th World Conference on Earthquake Engineering. Milan, Italy. 2024.

Project Experience

Quantitative Risk Analysis

Aeolian Vibration: Developed a probabilistic model for estimating the risk of first-strand failure of overhead transmission line bare conductors due to aeolian vibrations. Developed an innovative update to the model for covered conductors to estimate expected loss of useful life due to fatigue.

Nuclear Facilities: Developed a feature for the Multiphysics Object Oriented Simulation Environment (MOOSE) for stochastic ground motion simulation and sensitivity analysis for nuclear facilities assessments.

Reliability Analysis

Electric Reliability: Helped develop and implement a statistical electric reliability risk analysis framework for a large utility's service territory to support regulatory filings. Incorporated circuit characteristics and demographic characteristics of the populations served to assess potential service inequities in both reliability and involuntary disconnections.

Structural Response Reconstruction

Strong Motion Database: Published a comprehensive database of strong motion data from earthquakes over a 30-year period. Increased accessibility with an accompanying Python-based tool that circumvents the need for database querying.

Structural Response Reconstruction: Implemented a novel dual-phase machine learning technique for building seismic response predictions. Further developed a full-profile response prediction and assessment framework for regional scale assessments.