AIKATERINI P. KYPRIOTI

Personal Info:
Date of Birth: 1st September 1991
Gender: Female
Marital Status: Single
Citizenship: Greek

Current Position:
Assistant Professor,
School of Civil Engineering and
Environmental Science, Gallogly College of
Engineering, The University of Oklahoma

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Membership of Professional Societies:
Earthquake Engineering Research Institute - EERI (since 2017)
Society of Women in Engineering –SWE (since 2021)
Society for Industrial and Applied Mathematics –SIAM (since 2019)
American Society of Civil Engineers- Student Member (since 2020) – Member (since 2022)
Objective Resilience Committee (2022)
Structural Extreme Events Reconnaissance (StEER) – Level 1 Membership (2022)

Research Interests Outline

- Computational statistics (machine learning and scientific computing) applications for Natural Hazard (hurricanes, earthquakes) risk assessment and mitigation
- Development of real-time tools for storm surge forecasting and emergency planning
- Structural vulnerability assessment
- Structural dynamics
- Bayesian uncertainty quantification for civil engineering applications
- Application of data-driven methodologies (machine learning, data mining) in engineering practice
- Infrastructure resilience against natural hazards

EDUCATION

PhD   **University of Notre Dame**, USA,   Sept 2017-
Department of Civil &   June 2022
Environmental Engineering &Earth Sciences
<u>Dissertation</u>: "*Natural hazard risk assessment; promoting computational efficiency through advances in surrogate modeling*"
<u>Advisor</u>: Prof. Alexandros A. Taflanidis

Committee: Ahsan Kareem, Nicholas Zabaras, Andrew Kennedy
Norberto C. Nadal-Caraballo

MS	**University of Notre Dame**, **USA**,	Sept 2019-
	Department of Applied and Computational Mathematics & Statistics	May 2022

Research Master's Program intended to recognize master-level competency in applied and computational mathematics and statistics for students enrolled in a doctoral program at the University

MS	**Aristotle University of Thessaloniki**, **Greece**,	Sept 2015-
	Polytechnic School-Department of Civil Engineering	Sept 2016

"Earthquake Engineering and Seismic Design of Structures"
<u>Thesis</u>: "*Dynamic analysis under seismic load of a suspended roof*"
<u>Advisor</u>: Prof. Emeritus George C. Manos
Graduated 2nd among peers in 2016 (9.21/10)

BS	**Aristotle University of Thessaloniki**, **Greece**,	Sept 2009 -
	Polytechnic School-Department of Civil Engineering	Sept 2014

Major in structural engineering
<u>Thesis</u>: "*Static and dynamic analysis of a masonry protected monument building: evaluation of its bearing capacity and suggested restoration using RC jacketing*"
<u>Advisor</u>: Prof. Emeritus Christos Ignatakis
Graduated third with honors (8.78/10)

HONORS AND AWARDS

MAJOR AWARDS

Best Student Paper Award from *IASSAR* Awards Committee <u>Paper Title</u>: "*Kriging metamodeling for estimating EDP distributions in seismic applications utilizing stochastic ground motion models: addressing the different sources of excitation variability*"	2022
Winner of the EMI Dynamics Committee Student Paper Competition <u>Paper Title</u>: "*Kriging Surrogate Modeling for Approximating EDP Distributions under Stochastic Ground Motion Excitations*"	2021
Winner of the EMI Probabilistic Methods Committee Student Paper Competition <u>Paper Title</u>: "*Bayesian Calibration of Reduced Order Structural Models for Earthquake Risk Assessment Applications*"	2020
Outstanding Graduate Student Teaching Award	2019

The annual Outstanding Graduate Student TA or Instructor Award,
instituted in 1999 by Kaneb Learning Center, recognizes graduate student
instructors and TAs who demonstrate excellence in the classroom or teaching laboratory.

OTHER AWARDS

NHERI 2022 SimCenter Symposium, faculty travel award   2022
hosted by NHERI and NSF

Early Career travel award in Natural Hazards   2022
Research Summit 2022 hosted by NHERI and NSF

Travel award SIAM Student Travel Award to attend the 2020 SIAM   2020
Conference on uncertainty Quantification (UQ20)   (cancelled due to
Covid-19)

Graduate Student Government Conference Presentation Grant   2019

Fellow Scholarship Department of Civil Engineering in Aristotle University   2012-2013
Assistance in teaching and research activities in the Geotechnical Department

JOURNAL PUBLICATIONS

1. **Kyprioti, Aikaterini P.**, Christopher Irwin, Alexandros A. Taflanidis, Norberto C. Nadal-Caraballo, Madison C. Yawn, and Luke A. Aucoin. "Spatio-temporal storm surge emulation using Gaussian Process techniques." *Coastal Engineering* (2022): 104231.
https://doi.org/10.1016/j.coastaleng.2022.104231

2. Jung, WoongHee, **Aikaterini P. Kyprioti**, Ehsan Adeli, and Alexandros A. Taflanidis. "Exploring the sensitivity of probabilistic surge estimates to forecast errors." *Natural Hazards* (2022): 1-39.
https://doi.org/10.1007/s11069-022-05598-z

3. **Kyprioti**, Aikaterini P., and Alexandros A. Taflanidis. "Addressing the different sources of excitation variability in seismic response distribution estimation using kriging metamodeling." *Earthquake Engineering & Structural Dynamics*.
https://doi.org/10.1002/eqe.3696

4. **Kyprioti**, Aikaterini P., Alexandros A. Taflanidis, Norberto C. Nadal-Caraballo, Madison C. Yawn, and Luke A. Aucoin. "Integration of Node Classification in Storm Surge Surrogate Modeling." *Journal of Marine Science and Engineering* 10, no. 4 (2022): 551.
https://doi.org/10.3390/jmse10040551

5. **Kyprioti, Aikaterini P.**, Ehsan Adeli, Alexandros A. Taflanidis, Joannes J. Westerink, and Hendrik L. Tolman. "Probabilistic Storm Surge Estimation for Landfalling Hurricanes: Advancements in Computational Efficiency Using Quasi-Monte Carlo Techniques." *Journal of Marine Science and Engineering* 9, no. 12 (2021): 1322.

https://doi.org/10.3390/jmse9121322

6. **Kyprioti**, **Aikaterini P**., and Alexandros A. Taflanidis. "Kriging metamodeling for seismic response distribution estimation." *Earthquake Engineering & Structural Dynamics* (2021). https://doi.org/10.1002/eqe.3522

7. **Kyprioti, Aikaterini P**., Alexandros A. Taflanidis, Matthew Plumlee, Taylor G. Asher, Elaine Spiller, Richard A. Luettich, Brian Blanton, Tracy L. Kijewski-Correa, Andrew Kennedy, and Lauren Schmied. "Improvements in storm surge surrogate modeling for synthetic storm parameterization, node condition classification and implementation to small size databases." *Natural Hazards* (2021): 1-38. https://doi.org/10.1007/s11069-021-04881-9

8. **Kyprioti, Aikaterini P**., Alexandros A. Taflanidis, Norberto C. Nadal-Caraballo, and Madison Campbell. "Storm hazard analysis over extended geospatial grids utilizing surrogate models." *Coastal Engineering* (2021): 103855. https://doi.org/10.1016/j.coastaleng.2021.103855

9. **Kyprioti, Aikaterini P**., Alexandros A. Taflanidis, Norberto C. Nadal-Caraballo, and Madison O. Campbell. "Incorporation of sea level rise in storm surge surrogate modeling." *Natural Hazards* 105, no. 1 (2021): 531-563. https://doi.org/10.1007/s11069-020-04322-z

10. **Kyprioti, Aikaterini P**., Alexandros A. Taflanidis, and Andrew B. Kennedy. "Dissipation Effects of Coastal Vegetation on Nearshore Structures under Wave Runup Loading." *Journal of Structural Engineering* 147, no. 3 (2021): 06020010. https://doi.org/10.1061/(ASCE)ST.1943-541X.0002902

11. Patsialis, Dimitrios, **Aikaterini P**. **Kyprioti**, and Alexandros A. Taflanidis. "Bayesian calibration of hysteretic reduced order structural models for earthquake engineering applications." *Engineering Structures* 224 (2020): 111204. https://doi.org/10.1016/j.engstruct.2020.111204

12. **Kyprioti, Aikaterini P**., Jize Zhang, and Alexandros A. Taflanidis. "Adaptive design of experiments for global Kriging metamodeling through cross-validation information." *Structural and Multidisciplinary Optimization* 62, no. 3 (2020): 1135-1157. https://doi.org/10.1007/s00158-020-02543-1

13. Manos, G. C., K. Katakalos, L. Kotoulas, G. Koidis, **K**. **Kyprioti**, and V. Kourtidis. "The suspended roof of the Stavros Niarchos Foundation Cultural Center (SNFCC) at Athens, Greece: Laboratory tests and numerical simulations." *Soil Dynamics and Earthquake Engineering* 119 (2019): 408-421. https://doi.org/10.1016/j.soildyn.2018.03.019

JOURNAL PUBLICATIONS (UNDER REVIEW)

None currently

CONFERENCE PRESENTATIONS

1. "Coastal vegetation impact on structural vulnerability", oral in person presentation in NHERI 2022 SimCenter Symposium, Texas Advanced Computing Center (TACC), University of Texas at Austin, Texas, November 2022

2. "Efficient propagation of aleatoric uncertainties in the hazard description using stochastic emulation" & "Reinforcing coastal resiliency: how advancements in machine learning can guide ongoing efforts", Natural Hazards Research Summit, in person *poster presentations*, Washington DC, October 2022

3. "Kriging metamodeling for estimating EDP distributions in seismic applications utilizing stochastic ground motion models: Addressing the different sources of excitation variability", 13th International Conference on Structural Safety and Reliability (ICOSSAR 2021), Shanghai, P.R. China (virtual attendance), September 2022

4. "Integrated node condition classifier in storm surge surrogate modeling", Engineering Mechanics Institute Conference 2022, The Johns Hopkins University, Baltimore, May 2022

5. "Improvements in uncertainty quantification for probabilistic storm surge real-time forecasting", Ocean Sciences Meeting 2022, (virtual attendance), February 2022

6. "Incorporating Sea Level Rise in storm surge surrogate models", 7th Young Coastal Scientists and Engineers Conference – Americas, Myrtle Beach, South Carolina, October 2021

7. "Approximating EDP distributions under stochastic ground motions using Kriging surrogate modeling", UNCECOMP 2021: 4th International Conference on Uncertainty Quantification in Computational Sciences and Engineering, (virtual attendance), June 2021

8. "Kriging Surrogate Modeling for Approximating EDP Distributions under Stochastic Ground Motion Excitations", Engineering Mechanics Institute Conference 2021, Colombia University (virtual attendance), New York, May 2021

9. "Kriging Surrogate Modeling for Approximating EDP Distributions under Stochastic Ground Motion", UNCECOMP 2021 4th International Conference on Uncertainty Quantification in Computational Sciences and Engineering (virtual attendance), June 2021

10. "Coastal Vegetation Impact on Structural Integrity under Inundation Events", virtual International Conference on Coastal Engineering (vICCE), Australia (virtual attendance), October, 2020

11. "Bayesian Calibration of Reduced Order Structural Models for Earthquake Risk Assessment Applications" Probabilistic Methods Committee Engineering Mechanics Institute Conference 2020, Virtual Session for the PMC Competition, Colombia University (virtual attendance), New York May, 2020.

12. "Adaptive Design of Experiments for Kriging Metamodeling Through Cross-Validation Information." Engineering Mechanics Institute Conference 2019, Caltech, California, June, 2019.

13. "Recent Developments in Surrogate Modelling for Storm Risk Assessment." UNCECOMP 2019: 3rd International Conference on Uncertainty Quantification in Computational Sciences and Engineering, Crete, Greece, June, 2019.

During my PhD, I have collaborated on projects funded by the U.S. Army Corps of Engineers, the Federal Emergency Management Agency (FEMA), the National Oceanic and Atmospheric Administration (NOAA) and the National Science Foundation (NSF). Below is a quick overview of the main such projects.

➢ **Storm surge surrogate model advancements (2019-2022)**
Surrogate models have emerged as a key tool for storm surge predictions, developed utilizing databases of synthetic storm simulations and providing (when properly calibrated) accuracy similar to the high-fidelity numerical models that created such databases, while accommodating exceptionally high computational efficiency. Big part of my work has focused on enhancing surrogate modeling (metamodeling) applications in this context. Topics addressed in my research include: incorporation of Sea Level Rise effects in surge predictions for long-term regional planning; efficient hazard description over extensive geographical domains (with tens of thousands of locations of interest); coupling of classification and prediction techniques to improve accuracy of predictions; development of robust calibration and validation techniques for applications with small databases of synthetic storms. Such advancements have dramatically improved accuracy and robustness of storm surge surrogate models, addressing key existing research gaps. Currently improvements for time-series predictions are investigated.

➢ **Stochastic metamodeling for addressing aleatoric variability in seismic risk assessment (2020-2022)**
Addressing aleatoric (ground motion to ground motion) variability is a key challenge in seismic risk assessment. This work extended existing stochastic Kriging formulations to properly account for such uncertainties when seismic hazard is quantified through ground motion models. By considering partial replications for predicting the heteroscedastic characteristics of the aleatoric uncertainty, it established a highly efficient approximation, providing multi-fold computational improvement over alternative implementations. Extensions to different quantifications of the aleatoric variability are currently examined.

➢ **Impact of vegetation on vulnerability of coastal structures (2019-2020)**
Vulnerability assessment for coastal structures has become a topic of increased importance due to intensification and increased frequency of wave induced loads. This work examined the influence of vegetation on this vulnerability when considering exposure to wave run up loads. Work combined results of computational fluid dynamics simulations with structural fragility assessment approaches to examine the impact of vegetation on structural risk. It quantified the protection efficiency offered by the vegetation and related it to vegetation characteristics.

➢ **Improving NOAA's probabilistic storm surge forecasting (2019-2022)**
During landfalling events, NOAA is tasked with providing probabilistic surge estimates considering an ensemble of storms associated with forecast errors (defined through

historical data). This work investigates the implementation of efficient Monte Carlo and sensitivity analysis tools to improve the storm ensemble selection, setting as ultimate goal to improve statistical accuracy of the probabilistic surge estimates. Results are directly translated to computational products that can be integrated within the existing NOAA operational workflow for probabilistic surge estimation.

➢ **Bayesian model calibration for reduced order structural models (2019-2020)**
Bayesian model updating constitutes a powerful computational statistics tool for model calibration and selection. This work considered the application of such tools for the calibration of reduced order hysteretic structural models that are appropriate for earthquake engineering applications. In more detail, an efficient parameter estimation was performed, along with model class selection that identified the most appropriate model among a class of hysteretic models. In addition to these, a hierarchical implementation was examined in order to help in quantifying better the different sources of variability in the parameter estimation (dependence on the excitation data used in the calibration). The proposed formulation revealed the importance of considering a Bayesian model class selection, as well as the benefits that can be obtained by the hierarchical implementation. This established framework is a general tool that can be seamlessly extended to other practical engineering problems, beyond the one that was addressed in this research.

➢ **Adaptive Design of Experiments for global surrogate models using cross-validation information (2018-2019)**
Design of Experiments (DoE) techniques are a key aspect of modern machine learning based approaches, since they can accommodate accurate data-driven approximations with a smaller number of experiments (data). This work investigated a sequential DoE for development of surrogate models to replace computational expensive numerical simulators. It developed efficient optimization schemes and integrated cross-validation information to reduce the surrogate model bias, something that was shown to provide great benefits for applications with localized nonlinearities in the input domain.

TEACHING EXPERIENCE

Instructor of record for CE30200: Introduction to Structural Engineering   Jan-May 2022
University of Notre Dame, South Bend, USA

University of Notre Dame, South Bend, USA   Sep to Nov 2019
Online College Teaching Series, 6-week online series in the pedagogy,
design and technology of online education
Kaneb Center – ND Learning

University of Notre Dame, South Bend, USA   Sep 2019 to Dec 2019
Teaching Assistant, Department of Civil & Environmental
Engineering & Earth Sciences / Department of Aerospace and
Mechanical Engineering, University of Notre Dame (Cross Listed)

- Instructor: Prof. Alexandros A. Taflanidis
- Course title: Applied Probability and Statistical Computing Methods for Scientists and Engineers CE 60140/ AME 70779
- Developed slides, notes, and homework
- Coordinated grading with a team of 2 teaching assistants

University of Notre Dame, South Bend, USA   Jan 2019 to May 2019 &
Teaching Assistant, Department of Civil & Environmental   Jan 2018 to May 2018
Engineering & Earth Sciences
- Instructor: Prof. Alexandros A. Taflanidis
- Course title: Modeling and Dynamics of Building Systems CE 30150
- Developed slides, notes, project and homework
- Coordinated grading with a team of 3-4 teaching assistants

University of Notre Dame, South Bend, USA   Sept 2017 to Dec 2017 &
Teaching Assistant, Department of Civil & Environmental   Dec 2018 to Dec 2018
Engineering & Earth Sciences
- Instructor: Prof. Ahsan Kareem
- Course title: Introduction to Structural Engineering CE 30200
- Developed slides, notes, project and homework
- Coordinated grading, organized the course, managing a team of 3-4 teaching assistants

SERVICE

Graduate Student President of EERI   May 2020 to present
(Earthquake Engineering Research Institute) chapter
Department of Civil and Environmental Engineering & Earth Sciences
University of Notre Dame

Graduate Orientation Ambassador   2018-2021
Graduate Orientation Ambassadors (GOAs) play a vital role in welcoming
new graduate students to Notre Dame. By serving as leaders to plan and implement a
comprehensive introduction to campus and graduate studies, and by serving as mentors
and guides to new students navigating a new environment, GOAs help provide a smooth
and successful transition for the newest members of the graduate community.

STEM-mentor for an undergraduate female first year in   2019
Engineering student. This mentorship program is held by the Association
for Women in Science (AWIS)

Expanding Your Horizons in Science & Mathematics Volunteer   2019
EYH is a one-day career conference for middle school girls (grades 6-8)
to inspire and educate them about careers in math, science, and engineering.

Volunteers were able to interact with young girls and explain their work and the challenges they have encounter thus far.

LANGUAGES

Greek: Native Language

English: Superior Listener, Superior Speaker, Superior Reading and Writing
University of Michigan – Proficiency in English – Level C2 (2007)
University of Cambridge – Lower in English – Level B2 (2006)
Greek National Foreign Language Exam System – Level B2 (2006)

Italian: Advanced Listener, Advanced Low Speaker, Advanced Reading and Writing
Istituto Italiano di Cultura in Atene - Diploma di Lingua Italiana Level B2 (2007)

Spanish: Advanced Listener, Advanced Low Speaker, Advanced Reading and Writing
Instituto Cervantes - Diploma de Español como Lengua Extrajera - Level B2 (2012)

German: Novice Listener, Novice Speaker, Novice Reading and Writing
Goethe Institut - Zertifikat Deutsch Level B1 (2005)

COMPUTER SKILLS

Programming: R, Python

Applications: MatLab, OpenSees, OpenFoam, AutoCAD, SAP2000, Etabs, Mathematica, Adobe Illustrator, Latex

Platforms: Windows, macOS

OTHER

Interests/Hobbies: Sports, Music, Theater, Architecture (volunteered 2 years as tour guide during Architectural week in Thessaloniki-Greece), child care and education (past work experience), Volunteering (in planning and organizing athletic event (marathons, gym opening, etc.) – Proud Volunteer of "Special Olympics ATHENS 2011"), Greek traditional Dancing (dance troupe member in the Greek Orthodox Church of Saint Andrew's in South Bend).