CURRICULUM VITAE

IOANNIS KALOGERIS

School of Civil Engineering, National Technical University of Athens
Laboratory of Structural Analysis and Seismic Research &
Department of Civil Engineering, University of Thessaly
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PROFILE

Dr. Ioannis Kalogeris received his civil engineering diploma from the School of Civil Engineering at the National Technical University of Athens (NTUA) in 2011. He completed the postgraduate programme "Analysis and Design of Structures" in 2014. Later that year he commenced his Ph.D. in the field of Computational Mechanics under the supervision of Professor Vissarion Papadopoulos from the Institute of Structural Analysis & Seismic Research (ISASR) at NTUA. Concurrently with his Ph.D., Dr. Kalogeris pursued a second degree from the Mathematics department at the National & Kapodistrian University of Athens and a second Master's in this field, to further improve his scientific skills and contribute new ideas to computational mechanics. Following the successful defense of his Ph.D. thesis in early 2020, Dr. Kalogeris continued his research as a post-doctoral fellow at ISASR until October 2021. He then accepted a postdoctoral fellowship in the Department of Mechanical and Process Engineering at Eidgenössiche Technische Hochschule Zürich, until April 2023, when he returned to ISASR and resumed his work as a postdoctoral researcher.

His primary research interests lie in the field of Applied and Computational Mechanics. Specifically, his research focuses on advanced finite element methods, analysis and design of composite materials, computational methods for uncertainty quantification and reliability, Bayesian approaches for model parameter inference, and machine learning techniques for surrogate modeling. His research has led to the development of novel methodologies and algorithms, capable of handling computationally challenging engineering problems, such as stochastic nonlinear dynamic analysis of structures and multiscale analysis of structures composed of reinforced composites. He has published 17 research papers in high-impact factor scientific journals (*Scopus h-index* 9, *Google Scholar h-index* 11) and has a strong presence at international conferences in computational mechanics.

Dr. Kalogeris has participated in various European and National research programs relevant to field of computational science and engineering, from which he gained valuable experience and knowledge. Moreover, he is a member of the MGroup research team (https://github.com/mgroupntua/), actively contributing to the development of a multi-purpose finite element software for advanced engineering applications. He is responsible for developing several software modules of MSolve, including the Machine Learning and Uncertainty Quantification module, and has made important contributions to the software's Finite element and Solvers libraries. Additionally, he has professional experience in the static design of civil engineering structures and has worked as an independent programmer developing software solutions.

In October 2022, he accepted the position of Contract Lecturer at the Department of Civil Engineering of the University of Thessaly (UTH). He taught the undergraduate courses *Structural Dynamics II & Finite Element Methods* in the Fall semester and *Structural Dynamics I* in the Spring semester, as sole

lecturer. His contract with the Department of Civil Engineering at UTH was renewed for the academic year 2023-2024, and besides the previously mentioned courses, he also serves as the lecturer for the course *Strength of Materials II* in the Spring semester of 2024.

RESEARCH INTERESTS

- Mathematical modelling for solid mechanics, heat transfer and electrical conductivity problems.
- Multiscale finite element analysis.
- Development of surrogate modelling strategies for parameterized problems in computational mechanics using machine learning.
- Stochastic finite element methods.
- Data assimilation based on Bayesian inference methods to improve the accuracy of numerical models.
- Analysis and design of composite materials with target mechanical, thermal and electrical properties.
- Efficient solution strategies for large-scale linear systems.

TECHNICAL SKILLS & OTHERS

Programming Languages	C#, Python, Fortran
Scientific Software	MATLAB, Mathematica, Maple, Abaqus, Ansys, Sap2000, Etabs
Other Software	LaTeX, Microsoft Office
Languages	Greek, Engish-Proficiency of Cambridge, German-Mittelstufe
Military Service	completed (Oct. 2011 - Jun. 2012)

EDUCATION

 Ph.D. in Computational Mechanics National Technical University of Athens School of Civil Engineering Institute of Structural Analysis & Seismic Research Ph.D. thesis title: Advanced surrogate modeling and machine learning tic mechanics 	Oct. 2014 - Feb. 2020 ng methods in computational stochas-
M. Sc. in Mathematics National and Kapodistrian University of Athens School of Science Department of Mathematics	<i>Oct. 2020 - Dec. 2023</i> Very Good 7.78/10.0
M.Sc in Analysis and Design of Structures National Technical University of Athens School of Civil Engineering Institute of Structural Analysis & Seismic Research	Sep. 2012 - Jul. 2014 Very Good 8.87/10.0
Bachelor in Mathematics National and Kapodistrian University of Athens School of Science Department of Mathematics Concentration: <i>Theoretical Mathematics</i>	Mar. 2017 - Nov. 2020 Very Good 8.00/10.0

National Technical University of AthensVery Good 7.54/10.0School of Civil EngineeringInstitute of Structural Analysis & Seismic Research
Concentration: Structural EngineeringSep. 2003 - 2006Certificate of graduation (High School)Sep. 2003 - 2006Kareas High School, AthensExcellent 19.25/20.0

Sep. 2006 - Oct. 2011

ACADEMIC RECORD

Diploma in Civil Engineering

Contract lecturer University of Thessaly Department of Civil Engineering	Oct. 2022 - to date
Postdoctoral researcher in Computational Mechanics Eidgenössiche Technische Hochschule Zürich Department of Mechanical and Process Engineering	Nov. 2021 - Apr. 2022
Postdoctoral researcher in Computational Mechanics National Technical University of Athens School of Civil Engineering Institute of Structural Analysis & Seismic Research	Feb. 2020 - Oct. 2021 & Apr. 2022 - to date

DISSERTATIONS

- (A1) I. Kalogeris, "Advanced surrogate modeling and machine learning methods in computational stochastic mechanics", Ph.D. Dissertation, Technical University of Athens, Greece, 2020
 - My Ph.D. dissertation focuses on methods to perform uncertainty quantification in structural problems, which has become a crucial aspect of engineering applications. The stochastic finite element method (SFEM) has emerged as a solution to include unpredictable factors in modeling, extending classic finite element methods to systems with inherent uncertainties in initial conditions, material properties, geometry or loading. SFEM addresses systems governed by stochastic partial differential equations, serving as a powerful computational tool. While analytic solutions to these equations are rare, numerical methods, particularly Monte Carlo simulation, are widely employed. However, Monte Carlo simulation becomes computationally prohibitive for complex models, where each model simulation requires a significant amount of time to complete. To address this, my thesis presents methodologies leveraging surrogate modeling and machine learning within the SFEM framework. The first methodology adapts the Probability Density Evolution Method (PDEM) to general stochastic systems, enhancing its accuracy and reducing computational burden using the Streamline Upwind/Petrov Galerkin scheme. The second methodology utilizes PDEM to estimate stochastic limit loads and load-displacement curves in nonlinear structural analysis. The third methodology extends the Spectral Stochastic Finite Element Method for geometrically nonlinear framed structures, by projecting the stochastic incremental displacements onto the Polynomial Chaos basis and obtaining their values after solving an augmented system of nonlinear equations. Lastly, a methodology is proposed to construct an emulator of the computational model using the Diffusion Maps manifold learning algorithm, which is subsequently used to reduce the computational burden of the Monte Carlo simulation.
- (A2) I. Kalogeris, "Exploring Obata's theorem: Insights and Applications in Differential Geometry", MSc Dissertation, National and Kapodistrian University of Athens, Greece, 2023, https://pergamos.lib.uoa.gr/uoa/dl/object/3361960#fields

- This thesis investigated Obata's Theorem, its extensions, relations and similarities to other important theorems in Riemannian Geometry. Obata's Theorem, a fundamental result in Riemannian geometry, establishes a profound connection between the curvature of a Riemannian manifold and the behavior of the eigenvalues of the Laplace operator under isometric deformations. Through a meticulous examination of the theorem's origins, proofs, and implications, this research uncovers its deep-seated mathematical foundations and unveils its significance in the broader context of differential geometry. By elucidating the intricate interplay between curvature, isometries, and eigenvalues, this study contributes to a more profound understanding of the geometric and topological properties underlying Riemannian manifolds.
- (A3) I. Kalogeris, "Assessment of conventional intensity measures in performance based design of structures", MSc Dissertation, Technical University of Athens, Greece, 2014 (in Greek), https: //dspace.lib.ntua.gr/xmlui/handle/123456789/39637
 - The purpose of this work was the study of some advanced scalar intensity measures (IMs) and their application in Performance-Based Earthquake Engineering (PBEE). These measures were compared to $Sa(T_1)$ in terms of efficiency, sufficiency, scaling robustness, and hazard computability. Our test case was a 12-story reinforced concrete building, and the analyses were performed with the program OpenSees (Open System For Earthquake Engineering). A seismic hazard analysis methodology was proposed for the advanced IMs, and lastly, their potential use in PBEE was discussed.
- (A4) I. Kalogeris, "Assessment of the seismic behavior of the Eirini bridge", Diploma thesis, Technical University of Athens, Greece, 2011 (in Greek), https://dspace.lib.ntua.gr/xmlui/handle/ 123456789/6149
 - This thesis investigated the seismic behavior of the Eirini Bridge on Egnatia Odos, using the program SAP 2000 version 14. Initially, we performed inelastic analyses in each direction, transverse and longitudinal, in order to evaluate the pushover curves for the structure. In these analyses, two types of plastic hinges were used: flexural and fiber. Then, we transformed the pushover curves into ADRS spectra and used the Capacity Spectrum Method. Furthermore, we applied the Displacement Coefficient Method, and based on the results of these two methods, we were able to assess the expected level of damage for the earthquake of design. Lastly, we repeated the aforementioned analyses with P- Δ effects included this time, and we arrived at the final conclusions.

PUBLICATIONS IN INTERNATIONAL PEER-REVIEWED JOURNALS

- (B18) Leonidas P., Atzarakis, K., Sotiropoulos, G.Kalogeris I., Papadopoulos V., Fusing nonlinear solvers with transformers for accelerating the solution of parametric transient problems, Computer Methods in Applied Mechanics and Engineering, 2024
- (B17) Nikolopoulos S., Kalogeris I., Stavroulakis G., Papadopoulos V., AI-enhanced iterative solvers for accelerating the solution of large-scale parametrized systems, International Journal for Numerical Methods in Engineering, 2023
- (B16) Attia M., Khandaker M.A.H., Pyrialakos S., Kalogeris I., Enhancing the performance of antiblast windows through the use of carbon nanotube reinforced polymer gaskets, Journal of Building Engineering, 2023
- (B15) Pyrialakos S., **Kalogeris I.**, Papadopoulos V., *Multiscale analysis of nonlinear systems using a hierarchy of deep neural networks*, International Journal of Solids and Structures, 2023
- (B14) Papadopoulos L., Bakalakos S., Nikolopoulos S., Kalogeris I., Papadopoulos V., A computational framework for the indirect estimation of interface thermal resistance of composite materials using XPINNs, International Journal of Heat and Mass Transfer, vol. 200, 2023

- (B13) Kalogeris I., Pyrialakos S., Kokkinos O., Papadopoulos V., Stochastic optimization of carbon nanotube reinforced concrete for enhanced structural performance, Engineering with Computers, doi: https://doi.org/10.1007/s00366-022-01693-8, 2022
- (B12) Nikolopoulos S., Kalogeris I., Papadopoulos V., Machine learning accelerated transient analysis of stochastic nonlinear structures, Engineering Structures, vol. 257. 2022
- (B11) Fuhg, J.N., Kalogeris I., Fau, A., Bouklas, N., Interval and fuzzy physics-informed neural networks for uncertain fields, Probabilistic Engineering Mechanics, vol. 68, 2022
- (B10) Nikolopoulos S., Kalogeris I., Papadopoulos V., Non-intrusive surrogate modeling for parametrized time-dependent PDEs using convolutional autoencoders, Engineering Applications of Artificial Intelligence, vol. 109, 2022
- (B9) Bakalakos S., Kalogeris I., Papadopoulos V., Papadrakakis M., Maroulas P., Dragatogiannis D.A., Charitidis C.A., An integrated XFEM modeling with experimental measurements for optimizing thermal conductivity in carbon nanotube reinforced polyethylene, Modelling and Simulation in Materials Science and Engineering, 2022
- (B8) Lu X., Yvonnet J., Papadopoulos L., Kalogeris I., Papadopoulos V., A stochastic FE² data-driven method for nonlinear multiscale modeling, Materials, vol. 14, 2021
- (B7) Pyrialakos S., Kalogeris I., Sotiropoulos G., Papadopoulos V., A neural network-aided Bayesian identification framework for multiscale modeling of nanocomposites, Computer Methods in Applied Mechanics and Engineering, vol. 384, 2021
- (B6) Kalogeris I., Papadopoulos V., Diffusion maps-aided Neural Networks for the solution of parametrized PDEs, Computer Methods in Applied Mechanics and Engineering, vol. 376, 2021
- (B5) Bakalakos S., Kalogeris I., Papadopoulos V., An extended finite element method formulation for modeling multi-phase boundary interactions in steady state heat conduction problems, Composite Structures, vol. 258, 2021
- (B4) Kalogeris I., Papadopoulos V., Diffusion maps-based surrogate modeling: An alternative machine learning approach, International Journal of Numerical Methods in Engineering, vol. 121, pp. 602-620, 2020
- (B3) Papadopoulos V., Kalogeris I., Giovanis D., A spectral stochastic formulation for nonlinear framed structures, Probabilistic Engineering Mechanics, vol. 55, pp. 90-101, 2019
- (B2) Kalogeris I., Papadopoulos V., Limit analysis of stochastic structures in the framework of the probability Density Evolution Method, Engineering Structures, vol. 160, pp. 304-313, 2018
- (B1) Papadopoulos V., Kalogeris I., A Galerkin-based formulation of the probability density evolution method for general stochastic finite element systems, Computational Mechanics, vol. 57, pp. 701-716, 2016

RESEARCH PERFORMANCE INDICES (LAST UPDATE 12/05/2024)

Source	Citations	h-index
Google scholar	271	11
Scopus	178 (exc. self citations of all authors: 142)	9

TEACHING EXPERIENCE

• Contract lecturer in University of Thessaly (UTH), Department of Civil Engineering Courses:

- Strength of Materials II (1 semester, Spring 2024): Mechanical Properties of Materials, Beam Theory, Torsion, Buckling Theory, Energy Methods
- Structural Dynamics I (2 semesters, Spring 2023 & 2024): Formulation of dynamic governing equations, Study of Single- and M-DOF linear oscillators, Free and Forced vibrations, the effect of Damping, Mode Superposition Method, Numerical Methods
- Structural Dynamics II (2 semesters, Fall 2022 & 2023): Analysis and Design of Structures under Dynamic Loads, Design of Earthquake-Resistant structures according to Eurocode 8, Modal Response Analysis, Response Spectrum Analysis, Dynamic Behavior of Nonlinear structures
- Finite Element Methods (2 semesters, Fall 2022 & 2023): Principle of Virtual Work, Strong and Weak form of Partial Differential Equations, Galerkin Method, Types of Finite Elements and their Properties, Discretization of Structures into Finite Elements, Selection of appropriate element types and meshing strategies, Applications using a commercial FEA software package (Abaqus/CAE, DASSAULT SYSTEMES)
- Teaching assistant in National Technical University of Athens (NTUA), School of Civil Engineering Courses: Stochastic finite elements (graduate course - 5 semesters), Data-driven models in Engineering Applications (graduate course - 2 semesters), Computer-aided Analysis and Design of Structures (2 semesters), Advanced topics in Finite Element Analysis (1 semester), Static Analysis of Structures (1 semester)
- Teaching assistant in School of Pedagogical and Technological Education (ASPAITE), Department of Civil Engineering Course: **Probabilistic Analysis and Reliability Analysis of structures** (graduate course)

PARTICIPATION IN RESEARCH PROJECTS

- Data driven computational mechanics at exascale (**DCoMEX**), under the call H2020-JTIEuroHPC-2019-1, Budget: 3.000.000 Euros, project's duration 3 years (Participation: 1/10/2021-31/10/2023)
 - My role as a researcher on the project pertained to (a) the development of efficient surrogate modelling techniques using machine learning algorithms for complex parameterized problems in computational mechanics, (b) implementation of state-of-the-art solvers for large-scale linear systems and (c) the development of novel algorithms that combine linear algebra solvers and machine learning to accelerate the solution process of large-scale parameterized problems.
- Design of Hyperconcrete reinforced with nanomaterials, Supporting Researchers of the Operational Program 'Education and Lifelong Learning', National Ministry of Development and Investments, Budget: 45.000 Euros, project's duration 15 months (Participation: 1/6/2020-31/8/2021)
 - My role as a researcher on the project pertained to (a) the development of a multiscale finite element model to predict the mechanical properties of concrete reinforced with carbon-based nanomaterials, (b) the development of a customized surrogate modelling strategy to alleviate the immense computational requirements of multiscale analysis and (c) the development of a methodology to update the numerical model based on available experimental measurements using Bayesian inference algorithms.
- Optimal multiscale design of innovative materials for heat exchange applications, (HEAT-68/1286), European Regional Development Fund and Greek national Funds through the Operational Program Competitiveness, Entrepreneurship and Innovation, under the call Research-Create-Innovate, Budget: 800.000 Euros, project's duration 3 years (Participation: 10/12/2018-31/12/2019)
 - My role as a researcher on the project pertained to (a) the development of an extended finite element (X-FEM) formulation to model heat transfer on polymers reinforced with carbon

nanotubes (CNTs), capable of taking into account the interface interactions between the different material phases, and (b) the numerical investigation of the optimal microstructural configurations that maximize the effective thermal conductivity of the composite.

- Analysis and Performance-based design of structures comprised of composite materials, Research projects for Excellency, IKY/SIEMENS, Budget: 50.000 Euros, project's duration 2 years (Participation: 1/9/2015-31/8/2017)
 - My role as a researcher on the project pertained to (a) the development of multiscale finite element methods based on the concept of numerical homogenization to analyze the behavior of composite materials, (b) the development of efficient algorithms for performing stochastic multiscale analysis on structures composed of composite materials, and (c) the development of a rational framework for performing reliability analysis and performance-based structural design.
- Mastering the computational challenges in numerical modeling and optimum design of CNT reinforced composites, (MASTER), European Research Council Advanced Grant. Budget: 2.500.000 Euros, project's duration 5 years (Participation: 1/10/2014-28/2/2018)
 - My role as a researcher on the project pertained to the development of efficient stochastic algorithms for (a) modelling the random microstructural configurations of CNT-reinforced composites using stochastic series representation methods and (b) performing uncertainty propagation on structures composed of these composite materials using stochastic finite element methods.

CONSULTANCY/PROFESSIONAL EXPERIENCE

- Greek Ministry of Culture "Preliminary static study of the REX theater and the building of Sikiarideio, in Athens", 2023
- Next Generation Computational Mechanics and Engineering (NCOMP), Private Company "Prediction of the performance behavior of telecommunication antennas using Diffusion Maps", 2022
- Next Generation Computational Mechanics and Engineering (NCOMP), Private Company "Integration testing of stochastic analysis and computational mechanics software", 2022

MEMBERSHIPS

• Member of the Technical Chamber of Greece	2012-to date
• Member of the Greek Association of Computational Mechanics	2021-to date
• Member of the ECCOMAS Young Investigators Committee	2022-to date

REVIEWER IN JOURNALS

- Computer Methods in Applied Mechanics and Engineering (10 articles)
- Engineering Applications of Artificial Intelligence (3 articles)
- Probabilistic Engineering Mechanics
- Computational Materials Science (1 article)
- Reliability Engineering and System Safety
- Computers & Mathematics with Applications (1 article)
- International Communications in Heat and Mass Transfer

- Communications in Nonlinear Science and Numerical Simulation
- Journal of Manufacturing Systems (1 article)
- Earthquake Engineering and Structural Dynamics
- Engineering Analysis with Boundary Elements (1 article)
- Mechanical Systems and Signal Processing (1 article)
- Fuel (1 article)

AWARDS, PRIZES & SCHOLARSHIPS

- Awarded by the Greek Association of Computational Mechanics for the best Ph.D. thesis in Greece, in the field of computational mechanics for the year 2020.
- Awarded by the State Scholarship Foundation a scholarship to acquire a Master's degree in Greece (2012-2013).
- Awarded by Eurobank for the best performance in the nationwide exams among all students of Karea High School (1000 Euros).

SELECTED CONFERENCE PRESENTATIONS

- Kalogeris I., Nikolopoulos S., Stavroulakis G., Papadopoulos V., AI-SOLVE: Fusing linear algebra with machine learning to accelerate the solution of large-scale parametrized systems, 17th U.S. National Congress on Computational Mechanics, Albuquerque, New Mexico, USA, 23-27 July 2023
- Kalogeris I., Pyrialakos S., Papadopoulos V., Multiscale analysis of structures composed of composite materials using a hierarchy of deep neural networks, 17th U.S. National Congress on Computational Mechanics, Albuquerque, New Mexico, USA, 23-27 July 2023
- 3. Nikolopoulos S., Kalogeris I., Papadopoulos V., Machine learning accelerated dynamic analysis of stochastic nonlinear structures, ECCOMAS Congress, Oslo, Norway, 5-9 July 2022
- 4. Pyrialakos S., Kalogeris I., Papadopoulos V., A FE⁴ multiscale scheme for CNT-reinforced concrete accelerated by deep neural networks, ECCOMAS Congress, Oslo, Norway, 5-9 July 2022
- Kalogeris I., Pyrialakos S., Bakalakos S., Kokkinos O., Papadopoulos V., Machine learningassisted stochastic optimization of structures comprised of nano-reinforced concrete, International Congress on Computational Mechanics organized by the Greek Association of Computational Mechanics (10th GRACM), Virtual Congress, 5-7 July 2021
- Pyrialakos S., Kalogeris I., Sotiropoulos G., Papadopoulos V., Bayesian Inference on Multiscale Models of Carbon-Reinforced Polymers accelerated by Deep Neural Networks, Engineering Mechanics Institute Conference (EMI), Virtual Congress, 25-28 May 2021
- Nikolopoulos S., Kalogeris I., Papadopoulos V., An autoencoder-based surrogate modeling approach for parametrized time-dependent PDEs, 14th World Conference on Computational Mechanics (WCCM XIV) and 8th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2020), joint Virtual Congress, 11-15 January 2021
- Pyrialakos S., Kalogeris I., Papadopoulos V., A Bayesian identification framework for multiscale analysis of nanocomposites, 14th World Conference on Computational Mechanics (WCCM XIV) and 8th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2020), joint Virtual Congress, 11-15 January 2021

- Nikolopoulos S., Kalogeris I., Papadopoulos V., A machine learning approach for parametric time-history analysis, XI International Conference on Structural Dynamics (EURODYN 2020), Athens, Greece, 23-26 November 2020
- 10. Kalogeris I., Papadopoulos V., A Diffusion Maps-based surrogate model for uncertainty quantification, 3nd International Conference on Uncertainty Quantification in computational science and engineering (UNCECOMP), Hersonissos, Crete, Greece, 24-26 June 2019
- Papadopoulos V., Kalogeris I., Ibraimakis M., Giovanis D., Consistent Bayesian update for multiscale analysis using subset simulation, 13th World Congress on Computational Mechanics (WCCM), New York, USA, 22-28 July 2018
- 12. Kalogeris I., Papadopoulos V., Giovanis D., A spectral stochastic finite element formulation for nonlinear analysis of stochastic structures, 8th Conference on Computational Stochastic Mechanics (CSM), Paros, Greece, 11-13 June 2018
- 13. Papadopoulos V., **Kalogeris I.**, Giovanis D., An SSFEM formulation for the stochastic analysis of nonlinear framed structures, 2nd International Conference on Uncertainty Quantification in computational science and engineering (UNCECOMP), Rhodes, Greece, 15-17 June 2017
- 14. Kalogeris I., Papadopoulos V. Probability Density Evolution Method for buckling analysis of stochastic systems, 7th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS 2016), Crete, Greece, 5-10 June 2016
- Papadopoulos V., Kalogeris I., A Streamline Upwind/Petrov-Galerkin solution of the Probability Density Evolution Method for static systems, Symposium on Reliability of Engineering System (SRES), Hangzhou, Shanghai, China, 15-17 October 2015