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Engineering & Scientific Consulting

Omar Abuodeh, Ph.D.

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Professional Profile

Dr. Omar Abuodeh is an accomplished professional specializing in structural health monitoring and finite element modeling for civil/structural engineering structures. He combines these skills with machine learning techniques to drive comprehensive analyses and innovative contributions to the field. His interdisciplinary mindset and commitment to excellence make him an asset in complex infrastructure resiliency and engineering systems projects. Dr. Abuodeh has expertise in structural health monitoring, output-only operational modal analysis (OMA), finite element analysis (FEA), machine learning (ML) techniques, data-driven analysis, signal processing, Python automation, and interdisciplinary collaboration

During his Ph.D. studies at Clemson University, Dr. Abuodeh utilized Output-Only OMA techniques and FEA to identify the system dynamics of bridges using the signals measured by vehicles. Before that, he conducted validation studies of tested retrofitted reinforced concrete members using FEMs. This work extended to employing data-driven techniques like machine learning to analyze and quantify parameters affecting structural responses under varying loading conditions.

Dr. Abuodeh's commitment to interdisciplinary work is exemplified by his research involving signals obtained from vehicles to identify the system dynamics of bridges. His proficiency in Python enabled him to aggregate signal records and visualize the behavior of these interactions. Additionally, he automated FEMs using Python to conduct parametric studies, resulting in the development of efficient guidelines for bridge inspections with vehicles. Furthermore, Dr. Abuodeh's dedication to resilient infrastructure led him to receive a prestigious two-year NSF fellowship at Clemson University. During this fellowship, he collaborated with doctoral students from various departments to propose the South Carolina State Engagement Hub (SCSEH). This initiative aimed to address resiliency to climate change-related extreme events through interdisciplinary efforts. In his final year, Dr. Abuodeh served as an instructor of record, imparting his expertise in structural mechanics to undergraduate engineering students.

Academic Credentials & Professional Honors

Ph.D., Civil Engineering, Clemson University, 2023

M.S., Civil Engineering, American University of Sharjah, UAE, 2019

B.S., Civil and Environmental Engineering, American University of Sharjah, UAE, 2016

Academic Appointments

Instructor of Record, Clemson University, Spring 2023

Prior Experience

Instructor of Record, Clemson University, Spring 2023

NSF Research Fellow, Clemson University, 2020-2022

Graduate Research Assistant, Clemson University, 2019-2020

Research Assistant, American University of Sharjah, 2017-2019

R&D Engineer, University of Sharjah, 2016-2017

Professional Affiliations

American Society of Civil Engineers (ASCE)

American Institute of Steel Construction (AISC)

Publications

Abuodeh, O. and Redmond, L. Investigation of Multiple-Vehicle Scenarios to Improve System Identification for Indirect Health Monitoring of Bridge Networks. *Engineering Structures*, 2023. (Under review)

Abuodeh, O. and Redmond, L. An autonomous and heuristic approach for extracting bridge frequencies from passing vehicles. *Engineering Structures*, Vol. 290, 2023.

Abuodeh, O., Locke, W., Redmond, L., Sreenivasulu, R.V., Schmid, M. Examining Methods for Modeling Road Surface Roughness Effects in Vehicle–Bridge Interaction Models via Physical Testing. In: *Conference Proceedings of the Society for Experimental Mechanics Series Dynamics of Civil Structures*, Vol. 2, 2023.

Locke, W., Mokalled, S., Abuodeh, O., Redmond, L., and McMahan, C. A Bayesian Estimation Technique for Multilevel Damage Classification in DBHM. In *Leveraging Artificial Intelligence in Engineering, management, and safety of infrastructure*, Taylor & Francis Ltd, 2022.

Abuodeh, O., Redmond, L. A Framework for Developing Efficient Vehicle-Bridge Interaction Models Within a Commercial Finite Element Software. In: *Conference Proceedings of the Society for Experimental Mechanics Series*, Springer, Vol. 2., 2023.

Mokalled, S., Locke, W., Abuodeh, O., Redmond, L., McMahan, C. Drive-by health monitoring of highway bridges using Bayesian estimation technique for damage classification. *Structural Control Health Monitoring*, Vol 29, 2022.

Abuodeh, O., Hawileh, R.A., and Abdalla J.A. Nonlinear finite element models of reinforced concrete beams strengthened in bending with mechanically fastened aluminum alloy plates. *Computers & Structures*, Vol. 253, 2021.

Abuodeh, O., Hawileh, R.A., and Abdalla J.A. Finite element modelling of aluminum alloy plated reinforced concrete beams. *Computers and Concrete*, Vol. 27, 2021.

Abuodeh, O., Abdalla J.A., and Hawileh, R.A. Flexural strengthening of RC beams using aluminum alloy plates with mechanically-fastened anchorage systems: An experimental investigation. *Engineering Structures*, Vol. 234, 2021.

Locke, W., Mokalled, S., Abuodeh, O., Redmond, L., and McMahan, C. An intelligently designed AI for

structural health monitoring of a reinforced concrete bridge. The Concrete Industry in the Era of AI, 2021.

Abuodeh, O., Abdalla J.A., and Hawileh, R.A. Assessment of compressive strength of Ultra-high Performance Concrete using deep machine learning techniques. Applied Soft Computing, Vol. 95, 2020.

Abuodeh, O., Abdalla J.A., and Hawileh, R.A. Prediction of shear strength and behavior of RC beams strengthened with externally bonded FRP sheets using machine learning techniques. Composite Structures, Vol. 234, 2020.

Abuodeh, O., and Abed, F. A Finite Element Model of a UHPC Beam Reinforced with HSS Bars. In: 8th International Conference on Modeling Simulation and Applied Optimization (ICMSAO), 2019.

Abuodeh, O., AlRifai, M., Hawileh, R.A., and Abdalla J.A. Finite element modelling of aluminum alloy plated beams. In: 8th International Conference on Modeling Simulation and Applied Optimization (ICMSAO), 2019.

Abuodeh, O., Abdalla J.A., and Hawileh, R.A. Prediction of compressive strength of ultra-high performance concrete using SFS and ANN. In: 8th International Conference on Modeling Simulation and Applied Optimization (ICMSAO), 2019.

Abuodeh, O., Abdalla J.A., and Hawileh, R.A. Predicting the shear capacity of FRP in shear strengthened RC beams using ANN and NID. In: 8th International Conference on Modeling Simulation and Applied Optimization (ICMSAO), 2019.

Abuodeh, O., Abdalla J.A., and Hawileh, R.A. The flexural behavior of bolting and bonding Aluminum Alloy plates to RC beams. In: Procedia Structural Integrity, 2019.

Presentations

Abuodeh, O. Examining Methods for Modeling Road Surface Roughness Effects in Vehicle–Bridge Interaction Models via Physical Testing. Presentation at the IMAC-XLI, Austin, TX, 2023.

Abuodeh, O. A Framework for Developing Efficient Vehicle-Bridge Interaction Models Within a Commercial Finite Element Software. Presentation at the IMAC-XLI, Orlando, FL, 2022.

Abuodeh, O. A Finite Element Model of a UHPC Beam Reinforced with HSS Bars. Presentation at 8th ICMSAO, Manama, Bahrain, 2019.

Abuodeh, O. Finite element modelling of aluminum alloy plated beams. Presentation at 8th ICMSAO, Manama, Bahrain, 2019.

Abuodeh, O. Prediction of compressive strength of ultra-high performance concrete using SFS and ANN. Presentation at 8th ICMSAO, Manama, Bahrain, 2019.

Abuodeh, O. Predicting the shear capacity of FRP in shear strengthened RC beams using ANN and NID. Presentation at 8th ICMSAO, Manama, Bahrain, 2019.