Exponent®
Engineering & Scientific Consulting

John Harmon, Ph.D.

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Professional Profile

Dr. Harmon specializes in engineering investigations of complex mechanical and civil engineering systems in various industries, including power and energy, aerospace, construction, space technology, and mining. Using his expertise in solid mechanics, structural dynamics, and failure analysis, Dr. Harmon often relies upon finite element analysis (FEA), multi-body simulation techniques, and physical testing to solve these engineering problems.

Prior to joining Exponent, Dr. Harmon worked in the grid-scale energy storage industry at Energy Vault, where his experience included the design, computer modeling, testing, and construction of solids-based gravitational energy storage systems (GESS), Li-ion battery energy storage systems (BESS) and pumped hydro storage (PHS). Examples of his contributions include work on Li-ion fire suppression strategies, wire rope analysis, fracture testing, wind turbine design, hoists and lifts, trolley wheels and bearings, seismic resistance, and concrete testing.

Dr. Harmon completed his PhD at Caltech in collaboration with NASA-JPL on predicting landing success on icy worlds in the solar system, such as Europa and Enceladus. Dr. Harmon used multi-body simulation techniques combined with ice sintering science to capture the process. Dr. Harmon's enabling contribution came from utilizing his knowledge in brittle fracture to enhance the state-of-the-art of computational modeling to include the brittle nature of porous surface ice. During his PhD, Dr. Harmon worked in collaboration with Rio Tinto to perform analysis on rock crushers and developed a novel computational technique to simulate the crushing process and predict resulting particle size distributions.

Dr. Harmon has been a licensed private pilot for over a decade and continues to fly regularly in his free time.

Academic Credentials & Professional Honors

Ph.D., Applied Mechanics, California Institute of Technology (Caltech), 2022

NASA Space Technology Research Fellow, 2019-2021

Academic Appointments

Teaching Assistant, Mechanics of Structures and Solids, Caltech, 2019

Prior Experience

Structural Analyst Engineer, Energy Vault, 2021-2024

Structural Dynamics Consultant, Independent (Contract from Energy Vault), 2017-2021

Professional Affiliations

American Society of Mechanical Engineers (ASME)

Publications

D. Seo, J.M. Harmon, J.E. Andrade, G. Buscarnera. DEM Simulation of the Compression of Crushable Sand: Does the Initial Particle Shape Matter? Geotechnique Letters. 2024.

J. Ulloa, Z. Zhou, J.M. Harmon, J.E. Andrade. Cyclic-Loading Effects in Sand: A Micromechanical Study Considering Particle Breakage. Granular Matter. 2024.

A. Rodriguez, J. Restrepo, J. Conte, J. Andrade, A. Rosakis, V. Gabuchian, J.M. Harmon, A. Nema, A. Pedretti. Seismic-Response Assessment of Multiblock Tower Structures for Energy Storage: 1/25 Scale. Journal of Structural Engineering. 2024.

J.M. Harmon, M.L. Cable, S.J. Moreland J.E. Andrade. Predicting the Effect of Surface Properties on Enceladus for Landing. The Planetary Science Journal. 2023.

J.M. Harmon, V. Gabuchian, A. Rosakis, J. Conte, J. Restrepo, A. Rodriguez, A. Nema, A. Pedretti, J. Andrade. Predicting the Seismic Behavior of Multiblock Tower Structures using the Level Set Discrete Element Method. Earthquake Engineering & Structural Dynamics. 2023.

J.E. Andrade, A.J. Rosakis, J.P. Conte, J.I. Restrepo, V. Gabuchian, J.M. Harmon, A. Rodriguez, A. Nema, A.R. Pedretti. A Framework to Assess the Seismic Performance of Multiblock Tower Structures as Gravity Energy Storage Systems. Journal of Engineering Mechanics. 2023.

J.M. Harmon, D. Seo, G. Buscarnera, J.E. Andrade. Insight into Contact Forces in Crushable Sand using Experiments and Predictive Particle-Scale Modeling. Geotechnique. 2022.

A.J. Rosakis, J.E. Andrade, V. Gabuchian, J.M. Harmon, J.P. Conte, J.I. Restrepo, A. Rodriguez, A. Nema, A.R. Pedretti. Implications of Buckingham's Pi Theorem to the Study of Similitude in Discrete Structures: Introduction of the R^N_F, μ^N and the S^N Dimensionless Numbers and the Concept of Structural Speed. ASME. Journal of Applied Mechanics. 2021.

J.M. Harmon, K. Karappiperis, L. Li, S. Moreland, J.E. Andrade. Modeling Connected Granular Media: Particle Bonding within the Level Set Discrete Element Method. Computer Methods in Applied Mechanics and Engineering. 2021.

K. Karappiperis, J.M. Harmon, E. Ando, C. Viggiani, J.E. Andrade. Investigating the incremental behavior of granular materials by in silico experiments. Journal of the Mechanics and Physics of Solids. 2020.

J.M. Harmon, D. Arthur, J.E. Andrade. Level Set Splitting in DEM for Modeling Breakage Mechanics. Computer Methods in Applied Mechanics and Engineering. 2020.