

Exponent®
Engineering & Scientific Consulting

Donovan Birky, Ph.D.

Associate | Mechanical Engineering
Menlo Park
+1-650-688-6979 | dbirky@exponent.com

Professional Profile

Donovan Birky, Ph.D., specializes in computational solid mechanics, finite element modeling (FEM), and physics-informed machine learning (PIML) for material modeling. Through his work, he has leveraged high-fidelity simulations and machine learning to develop interpretable material models that improve predictive capabilities while maintaining engineering trust and transparency. His expertise includes constitutive modeling, computational mechanics, machine learning for engineering applications, uncertainty quantification, and the development of physics-based surrogate models.

Prior to joining Exponent, Dr. Birky received his Ph.D. in Mechanical Engineering from the University of Utah. His doctoral research focused on developing physics-informed machine learning methods for modeling the yield behavior of porous ductile metals. He created a PIML framework that generated closed-form material models with fewer underlying assumptions than traditional analytical approaches, while enabling rigorous uncertainty quantification and improved characterization of microstructural variability.

Dr. Birky's research experience also includes structural dynamics and surrogate modeling. As an undergraduate at Fort Lewis College, he developed a physics-informed neural network framework to predict the dynamic response of structural beams, further advancing his expertise at the intersection of mechanics, simulation, and machine learning.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, University of Utah, 2026

M.S., Mechanical Engineering, University of Utah, 2022

B.S., General Engineering, Fort Lewis College, 2020

Publications

Birky D, Su A, Hamel C, Buche M, Emery J, Hochhalter J. Separating intrinsic and extrinsic uncertainty using a hierarchical Bayesian approach with scientific machine learning to learn implicit yield surface models. Probabilistic Engineering Mechanics 2026. Manuscript in review.

Birky D, Emery J, Hamel C, Hochhalter J. Learning implicit yield surface models with uncertainty quantification for noisy datasets. Computer Methods in Applied Mechanics and Engineering 2025; 436:117738.

Birky D, Garbrecht K, Emery J, Alleman C, Bomarito G, Hochhalter J. Generalizing the Gurson model using symbolic regression and transfer learning to relax inherent assumptions. Modelling and Simulation

© 2026 Exponent, Inc. All Rights Reserved

in Materials Science and Engineering 2023; 31(8):085005.

Garbrecht K, Birky D, Lester B, Emery J, Hochhalter J. Complementing a continuum thermodynamic approach to constitutive modeling with symbolic regression. Journal of the Mechanics and Physics of Solids 2023; 181:105472.

Birky D, Ladd J, Guardiola I, Young A. Predicting the dynamic response of a structure using an artificial neural network. Journal of Low Frequency Noise, Vibration and Active Control 2022; 41(1):182–195.

Presentations

Birky D, Su A, Buche M, Hamel C, Emery J, Hochhalter J. Calibration of implicit yield surface model parameters with multiple sources of uncertainty using scientific machine learning and a hierarchical Bayesian approach. Presentation, 17th World Congress on Computational Mechanics and 10th European Congress on Computational Methods in Applied Sciences and Engineering (WCCM-ECCOMAS), 2026.

Birky D, Hamel C, Emery J, Hochhalter J. Separation of intrinsic and extrinsic uncertainty sources using sequential Monte Carlo for constitutive model parameter calibration. Presentation, 18th US National Congress on Theoretical and Applied Mechanics (USNCTAM18), 2025.

Buche M, Hamel C, Su A, Narang H, Emery J, Alleman C, Lester B, Birky D, Garbrecht K, Hochhalter J, et al. Applying genetic programming symbolic regression to solid mechanics. Presentation, 1st Solid Mechanics Analysis Resource and Technical Exchange, 2024.

Birky D, Garbrecht K, Emery J, Hamel C, Bomarito G, Leser P, Hochhalter J. Methods for generating interpretable yield surface models with UQ based on data with multiple sources of uncertainty. Presentation, 16th World Congress on Computational Mechanics and 4th Pan American Congress on Computational Mechanics (WCCM-PANACM), 2024.

Birky D, Hamel C, Emery J, Hochhalter J. Modeling intrinsic uncertainty from material microstructure sources at the engineering scale using Bayesian symbolic regression. Presentation, 11th International Conference on Multiscale Materials Modeling (MMM11), 2024.

Birky D, Strauss N, Hochhalter J. Bayesian interpretable machine learning of yield surface models with noisy data. Presentation, 153rd TMS Annual Meeting & Exhibition, 2024.

Hochhalter J, Garbrecht K, Birky D, Randall D, Phung B, Strauss N, Emery J, Lester B, Alleman C, Buche M, et al. Interpretability and generalizability of constitutive models using symbolic regression. Presentation, 153rd TMS Annual Meeting & Exhibition, 2024.

Birky D, Garbrecht K, Emery J, Alleman C, Lester B, Bomarito G, Buche M, Hochhalter J. Uncertainty quantification for interpretable constitutive models using genetic programming based symbolic regression. Presentation, 17th US National Congress on Computational Mechanics (USNCCM17), 2023.

Birky D, Strauss N, Hochhalter JD, Emery JM, Alleman C, Buche MR. Interpretable machine learning for uncertain, microstructure-dependent constitutive models. Presentation, AIAA Science and Technology Forum and Exposition (AIAA SciTech Forum), 2022.

Birky D, Zamora J, Emery J, Alleman C, Lester B, Hochhalter J. A data-driven approach for improving the existing Gurson material damage model using genetic programming for symbolic regression. Presentation, 151st TMS Annual Meeting & Exhibition, 2022.

Birky D, Guardiola I, Young A. Efficient clustering of the dynamic response of a structure subject to impulse loading. Presentation, AIAA SciTech 2021 Forum, 2021.

Birky D, Zamora J, Emery J, Alleman C, Lester B, Bomarito G, Hochhalter J. Improved plasticity and

damage models by symbolic regression of microscale finite element simulations. Presentation, 16th US National Congress on Computational Mechanics (USNCCM16), 2021.

Zamora J, Birky D, Emery J, Alleman C, Lester B, Hochhalter J. Physics-informed machine learning for the development of microstructure-sensitive deformation and damage models in engineering applications. Presentation, ASME International Mechanical Engineering Congress & Exposition (ASME IMECE 2021), 2021.