



Exponent[®]
Engineering & Scientific Consulting

Sophia Relph, Ph.D.

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Professional Profile

Dr. Relph's background is in mechanical engineering, with a focus on fluid dynamics and experiment design. She has expertise in the areas of bubbly flows, jets, and free-surface phenomena, and her experience includes high-speed videography, the design and testing of flow control apparatuses, and digital image processing.

Prior to joining Exponent, Dr. Relph received her Ph.D. in mechanical engineering from the University of Maryland. During her doctoral studies, she used experimental techniques to examine the role that surface disturbances upon plunging liquid jets play in creating and transporting bubbles, with the goal of benefitting the metal casting industry by informing better estimates for air inclusions in castings. In pursuit of this goal, Dr. Relph employed high-speed camera-based measurement techniques, numerical analysis, and innovative experimental design to uncover the origins of entrained air bubbles. The optical techniques she employed include particle image velocimetry, background-oriented schlieren, and edge detection, enabling the non-invasive extraction of quantitative data such as pressure, velocity, surface deformation, and bubble volume.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, University of Maryland, 2025

B.S., Mechanical Engineering, University of Maryland, 2018

Academic Appointments

Graduate Teaching Assistant, University of Maryland, 2023-2025

Prior Experience

Graduate Research Assistant, University of Maryland, 2018-2025

Publications

Presentations

Relph S, Kiger K. A delicate balance: how Faraday waves and vortex shedding drive air entrainment. Presentation, 77th Annual Meeting of the APS Division of Fluid Dynamics, Salt Lake City, UT, 2024.

Relph S, Kiger K. Plunging liquid jets and the role of subharmonic gravity-capillary waves in air entrainment. Presentation, 76th Annual Meeting of the APS Division of Fluid Dynamics, Washington DC, 2023.

Relph S, Kiger K. Wave transformation and air entrainment by a forced plunging liquid jet. Presentation, 75th Annual Meeting of the APS Division of Fluid Dynamics, Indianapolis, IN, 2022.

Relph S, Kiger K. Wave transformation and air entrainment by a harmonically forced plunging jet. Presentation, 20th International Symposium on Application of Laser and Imaging Techniques to Fluid Mechanics, Lisbon, 2022.

Relph S. Free surface responses to a forced plunging jet. Presentation, 2021 Research Symposium on Environmental and Applied Fluid Dynamics, online, 2021.

Relph S, Kiger K, Dhruv A, Balaras E. Air entrainment mechanisms of a forced plunging jet. Presentation, 72nd Annual Meeting of the APS Division of Fluid Dynamics, Seattle, WA, 2019.