

Center for Environmental & Applied Fluid Mechanics

SPECIAL CEA FM SEMINAR



**“Neural Operators and
Beyond – The Changing
Landscape of Scientific
Computing”**

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Abstract: Operator learning is an emerging area in scientific machine learning which aims to learn mappings between infinite dimensional function spaces. In the first half of the talk, I will delve into the foundations of Wavelet Neural Operator (WNO), a recently developed operator learning algorithm. I will discuss its working principles and its potential applications in complex engineering problems including fracture propagation in brittle materials, tumor detection using USG data and elastography, and weather forecasting.



The second half of the talk will focus on what lies beyond neural operators. I will introduce a new scientific machine learning architecture that is loosely motivated from cognitive science. This architecture is a first of its kind foundation model and offers two key advantages: (i) it can simultaneously learn solution operators for multiple parametric PDEs, and (ii) rapid generalization to new parametric PDEs with minimal fine-tuning. We observe that the proposed architecture is robust against catastrophic forgetting and facilitates knowledge transfer across dissimilar tasks. Across a diverse array of mechanics problems, consistent performance enhancements are observed with this architecture compared to task-specific baseline operator learning frameworks.

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