

OCT
7

4th National Conference on Multidisciplinary Design, Analysis and Optimization



GRAPHS AND PHYSICS-INFORMED NEURAL NETWORKS (PINN) FOR HYBRID MODELING AND UNCERTAINTY QUANTIFICATION

Prof. Felipe Viana
University of Central Florida

6.00PM - 9.00PM: Lecture and Hands on

Dr. Felipe Viana is an Assistant Professor at UCF, where he leads the Probabilistic Mechanics Laboratory. His research focuses on fusing machine learning and probabilistic methods with physics-based models for optimization and uncertainty quantification.

He will discuss two different ways of building engineering models using neural networks. First, he will briefly present the use of neural networks to solve partial differential equations through collocation points (what is commonly referred to as "physics-informed neural networks"). Then, he will present a modeling framework that allows for the simultaneous use of physics-informed and machine learning by implementing hybrid neural networks. The main advantage of this approach is the compensation of limitations in physics-informed kernels as well as labeled data. This framework handles highly unbalanced datasets formed by few output observations and data-lakes containing time series used as inputs.

The tutorial will focus on both formulation and computational implementation. There will be hands-on examples on computational fluid dynamics, model identification of dynamic systems, and fatigue crack growth modeling written in the TensorFlow using the Python programming language API. The participants will have direct access to the Python scripts and will be able to run them on their personal laptop.