APPLIED MATHEMATICS COLLOQUIUM:
Learning how to accelerate numerical simulations

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Date:
11/18/2022

Time:
3:00 PM-5:20 PM

Location:
SSB 170

About The Speaker:

Thibault Faney received his PhD in computational material science from UC Berkeley in 2014. He is now a project leader at IFPEN aiming at improving numerical simulations with machine learning. This research project covers a large range of applications ranging from wake modeling for wind turbines to interface reconstruction in multiphase flow, and involves several research engineers, post-doctoral researchers and PhD students.

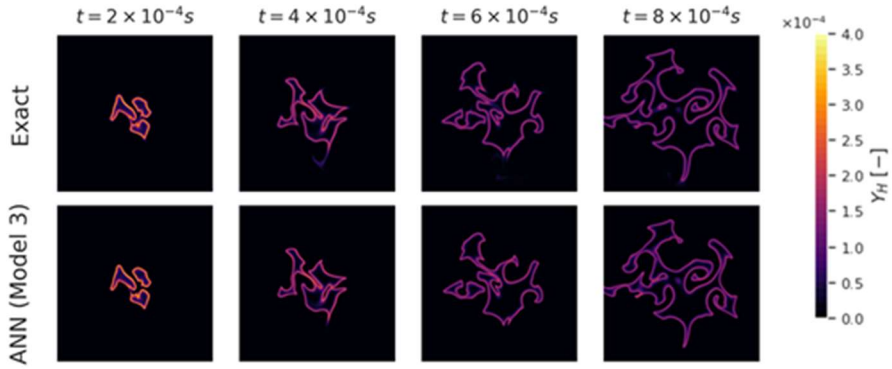

Figure 1: Combustion of Hydrogen (top: reference simulation, bottom: simulation using a learned model for chemical kinetics).

Abstract:

IFPEN is a multi-disciplinary French research institute dedicated to the advancement of energy and environmental technologies. Researchers at IFPEN work on a large scope of applications, from subsurface technologies (Geothermal Energy, CO2 sequestration, Enhanced Oil Recovery) to motor engines (combustion and electric), wind turbines, and chemical processes (fuel and biofuel synthesis, electric batteries, catalyst development). These various applications are modeled by coupled physical systems. Numerical simulations are an essential tool to understand and predict the behavior of such systems. However, design, optimization and real time simulation of these complex systems require increasing computational resources. At the same time, an increasing number of data, both from experiments and from simulations, is stored. The aim of this talk is to discuss how to bridge the gap between recent advances in learning algorithms (e.g., Deep Learning) that efficiently use available data and decades of development in numerical simulations that consider physical properties of the system to solve. I will illustrate a variety of approaches through a few specific applications ranging from thermodynamics and chemistry through computational fluid dynamics and molecular dynamics.

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