

University of Miami, Physics Department Colloquium

Date: Wednesday, Apr 5, 2023
Time: 4:00 pm – 5:00 pm
Location: Wilder Auditorium – Rm 112, Knight Physics Building

'Artificial Intelligence' for Flow Control and Data Analysis

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Abstract

'Artificial Intelligence' has made tremendous gains in recent years, and it is increasingly finding promising uses in various practical and scientific applications. But despite our optimistic outlook, the underlying algorithms do not possess 'intelligence' in the true sense of the word. Instead, they are extremely adept at identifying non-linear patterns in high-dimensional datasets. I will highlight how we have leveraged such algorithms to discover optimal control laws in extremely complex systems, especially when effective rules may not be evident a-priori. By coupling autonomous control algorithms with high-fidelity simulations of fish swimming, we have demonstrated that locomotion in schooling formations can lead to energy savings when individual fish interact judiciously with their companions' unsteady wakes. Adopting a reverse engineering approach has allowed us to understand how these autonomous decisions are driven by flow physics on a fundamental level. I will also highlight other work where Deep Learning techniques are used to accurately predict energetically important extreme events in wall-bounded turbulent flows. Importantly, these techniques allow us to focus on the inverse problem, where dynamically important 3D coherent structures are revealed in an entirely data-driven manner.