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CSC Seminar

SPEAKER

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TITLE

Where are we with data-driven surrogate modeling for various physical simulations?

ABSTRACT

A surrogate model is built to accelerate computationally expensive physical simulations, which is useful in multi-query problems, such as inverse problem, uncertainty quantification, design optimization, and optimal control. In this talk, two types of data-driven surrogate modeling techniques will be discussed, i.e., the black-box approach that incorporates only data and the physics-informed approach that incorporates the physics information as well as data within the surrogate models. The advantages and disadvantages of each method will be discussed. Furthermore, several recent developments of data-driven physics-informed surrogate modeling techniques at LLNL will be introduced in the context of various physical simulations. For example, the reduced order model overcomes the difficulty of shock propagation phenomenon, achieving a speedup of O(2~10) with a relative error less than 1% for relatively small Lagrangian hydrodynamics problems. The space–time reduced order model accelerates large-scale Neutron transport simulations by a factor of 7,000 with a relative error less than 1%. The nonlinear manifold reduced order model (NM-ROM) shows perfect marriage between machine learning and the traditional numerical methods of solving partial differential equations. NM-ROM also solves the challenge imposed by the advection-dominated physical simulations.

Tuesday, April 13, 2021 at 6 pm

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