Abstract Submitted
for the DFD20 Meeting of
The American Physical Society

Interface learning paradigms for multi-scale and multi-physics systems[1] SHADY AHMED, SURAJ PAWAR, OMER SAN, Oklahoma State University-Stillwater — A multitude of natural and engineered systems compromise multiple characteristic scales, multiple spatiotemporal domains, multiple physical closure laws, and even multiple disciplines. In a naive implementation of numerical simulation, the stiffest component dictates the spatial mesh resolution and time stepping requirements, making the solution of such systems computationally daunting. Instead, an ensemble of solvers and modeling approaches with varying levels of complexity has to be selected for efficient computations. This includes domain decomposition techniques, multi-fidelity solvers, and multi-geometrical abstractions. However, effective communications and information sharing among solvers have to be accomplished to guarantee solution convergence and reduce idle times. To this end, we exploit machine learning capabilities to provide physically-consistent interface conditions. A variety of interface learning paradigms are presented for full and reduced order modeling (FOM-ROM) coupling, macro-micro solvers coupling, and mixed-dimensional coupling using hybrid analysis and modeling (HAM) techniques.

[1]This material is based upon work supported by the U.S. Department of Energy, Office of Science, Office of Advanced Scientific Computing Research under Award Number DE-SC0019290.

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Date submitted: 03 Aug 2020 Electronic form version 1.4