PINN-PAD: Physics Informed Neural Networks in PADova
22–23 February 2024, Padova, Italy

Computational Paradigms in Scientific Machine Learning

D'Inverno Giuseppe Alessio[1], Brien D.[2], Varbella A.[2] and Gjorgiev B.[2]

[1] SISSA, Trieste
[2]ETH Zurich

The Alternating Current Optimal Power Flow (AC-OPF) is a highly non-linear non-convex optimization problem. The AC-OPF is often used to monitor real-time grid operations and thus the operators demand efficient and accurate algorithms. However, solving this problem is often computationally expensive for large power grids. In this work, we integrate the methods of Physics Informed Neural Networks (PINNs), Graph Neural Networks (GNNs) and Augmented Lagrangian methods in one algorithm to obtain highly accurate solutions. This approach takes advantage of the natural graph description of the power grid and ensures that the underlying physical rules and limitations are respected. We show via benchmark test cases this unsupervised approach provides a near-optimal solution that can be applied to different grids without having to adapt its architecture or hyperparameters.