

Structure-Aware Scientific Machine Learning for interface problems

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Interface problems arise in a broad range of applications, including multiphase flows, materials science, and biological membranes. Their numerical solution is challenging because jumps, derivative discontinuities, singular sources, and geometric constraints are often concentrated near lower-dimensional interfaces. Standard PINNs and neural PDE solvers may fail to resolve these structures accurately due to their smooth and generic representations. In this talk, I will present structure-aware scientific machine learning methods for interface-related PDEs. The main theme is to incorporate interface geometry, jump conditions, singular structures, and classical numerical discretizations into neural solvers. These methods demonstrate how scientific machine learning can move beyond black-box approximation toward neural PDE solvers that respect the analytical structure of interface problems.