Abstract Submitted
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Physics-Informed Neural Networks for the Modelling of Fluid-Structure Interactions ELIJAH ANG, BING FENG NG, Nanyang Technological University — This paper proposes the use of physics-informed neural networks (PINN) to overcome the large computational overheads in Fluid-Structure Interaction (FSI) simulations that couples Computational Fluid Dynamics (CFD) and Computational Structural Dynamics (CSD) modules. Rather than using the difference between predicted and targeted outputs which is common in conventional neural networks, PINNs uses residuals of governing equations as the loss function for the network. As a proof of concept, a PINN was trained to solve for flow over a flat plate, and the results were able to replicate Blasius similarity solution. The neural networks were trained by computing loss functions defined as the norm of the residuals calculated at randomly sampled collocation points. A gradient descent algorithm was subsequently used to minimize the loss by adjusting the weights and bias. By optimizing the residuals, the PINN acted as a function approximator for the solution of the partial differential equations which govern the physics of the problem. The use of PINN was further extended to solve more complex flow problems and to model structural dynamics, which are then coupled to solve FSI problems.

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