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Physics informed neural network for topology optimization

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ABSTRACT

This paper studies the physics informed neural networks (PINNs) as a numerical method for boundary value problem for topology optimization. PINNs use neural networks to approximate the solution of partial differential equations (PDEs). To approximate the solution, PINNs train the neural network by loss function which include the physical information of PDEs. In this study, the approaches to include physical information are compared. The governing equations of engineering problems can be handled by mathematical formulations such as strong form, weighted residual form, and energy functional form. PINNs can also use the formulations as an approach to include the physical information. As a numerical example for comparing approaches, the cantilever beam problem which is commonly used in topology optimization is used. This problem has stress concentrated when the load acts on a small area. PINNs' characteristics, pros and cons for topology optimization are checked by the example. As future work, topology optimization with physical information will be studied.

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