

A DEEP FIRST-ORDER SYSTEM LEAST SQUARES METHOD FOR SOLVING ELLIPTIC PDES

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ABSTRACT

We propose a First-Order System Least Squares (FOSLS) method based on deep-learning for numerically solving second-order elliptic PDEs. The method we propose is capable of dealing with either variational and non-variational problems, and because of its meshless nature, it can also deal with problems posed in high-dimensional domains. We prove the Γ -convergence of the neural network approximation towards the solution of the continuous problem, and extend the convergence proof to some well-known related methods. Finally, we present several numerical examples illustrating the performance of our discretization.

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