Finite Element Operator Network: Theory and Computation

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Partial differential equations (PDEs) underlie our understanding and prediction of natural phenomena across numerous fields, including physics, engineering, and finance. However, solving parametric PDEs is a complex task that necessitates efficient numerical methods. In this talk, I introduce a novel approach for solving parametric PDEs using a Finite Element Operator Network (FEONet). The proposed method leverages the power of deep learning in conjunction with traditional numerical methods, specifically the finite element method, to solve parametric PDEs in the absence of any paired input-output training data. I will demonstrate the effectiveness of our approach on several benchmark problems and show that it outperforms existing methods in terms of accuracy, generalization, and computational flexibility. Furthermore, I will also provide theoretical convergence analysis to support our approach in the numerical analysis framework.