Randomized Neural Networks with Petrov–Galerkin Methods for Solving Linear Elasticity problem

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We develop the Randomized Neural Networks with Petrov-Galerkin Methods (RNN-PG methods), which use the Petrov-Galerkin variational framework, where the solution is approximated by randomized neural networks and the test functions can be employed in a flexible choice. Unlike conventional neural networks, the parameters of the hidden layers of the randomized neural networks are fixed randomly, while the parameters of the output layer are determined by the least squares method, which can effectively approximate the solution. We also develop mixed RNN-PG methods for linear elasticity problems, which ensure the symmetry of the stress tensor and avoid locking effects. We compare RNN-PG methods with different methods on several examples, and the numerical results demonstrate that RNN-PG methods achieve higher accuracy and efficiency.