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MESH GENERATION FOR FINITE ELEMENT SIMULATIONS WITH DEEP LEARNING

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The finite element method is one of the most widely used methods in computational engineering and science, both in the industry and academia. Generally, it provides an approximate solution to a given boundary value problem. The quality of this solution critically depends on the underlying discretization, the so-called mesh. While finer meshes in general allow a higher accuracy of the approximate solution, they are also associated with a higher computational cost. Therefore, generating a mesh that ensures a good trade-off between both is key in the application of the finite element method.

As it is often hard to know a priori how to discretize a given boundary problem in an optimal way, methods for adaptive mesh refinement have been developed over the last decades. These typically required several intermediate solutions.

Here we suggest a new procedure for the generation of meshes for finite element simulations. A deep neural network is provided training data from several example problems. From this training data, the network can learn the ability to support the meshing process. Using numerical examples, we demonstrate how this procedure can help in generating suitable meshes for problems such as linear elasticity problems from solid mechanics.