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A Parameterized Level Set Method with Polygonal Finite Elements in Topology Optimization

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Abstract

The level set based topology optimization models have received considerable attention in the last decade, however, most of the approaches are implemented considering regular design domains and structured meshes. In this presentation, we introduce the parameterized level set model for solving topology optimization problems with polygonal finite elements in generic design domains (non-box geometries) with unstructured grids. The level set function is parameterized and updated using radial basis functions (RBFs) of which the knots are not necessarily located on a structured mesh grid. Thus such RBFs can be effortlessly combined with polygonal finite elements to solve topology optimization problems in irregular design domains. Furthermore, the reinitialization approach, which is common in the literature, is not necessary in our approach. Moreover, its hole-nucleation capability can be helpful to achieve more flexible designs. Some implementation details and parameters are studied with several examples. The optimal results illustrate the effectiveness of the proposed model.