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Why Parameterizing Element Connectivity for Topology Optimization?

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Recently, a new topology optimization formulation, called the element connectivity parameterization (ECP), has been proposed. The objective of this work is to present the motivation for the development of ECP, the idea behind it and its applications to some topology optimization problems which are otherwise difficult to solve. We begin with the issue of unstable elements for topology design problems involving nonlinear analysis and ascribe the source of the numerical problem to the intermediate density element of the conventional topology optimization formulation. To overcome the numerical problem, the degree of element connectivity is used to describe structural layouts while finite elements remain solid during whole topology optimization iterations. A few numerical exmaples are considered to show the usefulness of ECP.

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