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FEA Structural Optimization Based on Metagraphs

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Abstract

Evolutionary Structural Optimization (ESO) seeks to mimic the form in which nature designs shapes. This paper focuses on shape carving triggered by environmental stimuli. In this realm, existing algorithms delete under - stressed parts of a basic shape, until a reasonably efficient (under some criterion) shape emerges. In the present article, we state a generalization of such approaches in two forms: (1) We use a formalism that enables stimuli from different sources, in addition to stress ones (e.g. kinematic constraints, friction, abrasion). (2) We use metagraphs built on the Finite Element constraint graphs to eliminate the dependency of the evolution on the particular neighborhood chosen to be deleted in a given iteration. The proposed methodology emulates 2D landmark cases of ESO. Future work addresses the implementation of such stimuli type, the integration of our algorithm with evolutionary based techniques and the extension of the method to 3D shapes.

Keywords

Topology optimization Evolutionary structural optimization
Mathematical graph

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