TOPOLOGY OPTIMIZATION OF STRUCTURES OR PERIODIC SOLIDS WITH LINEARIZED ELASTIC BUCKLING CRITERION

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This work describes a topology optimization methodology for a linearized elastic buckling criterion based on a two-scale asymptotic method for periodic materials [1]. This two-scale method provides a set of uncoupled problems for the elastic stability analysis at the macroscale and the microscale material levels respectively. A brief discussion of its range of applicability and an interpretation of the governing equations is presented from an engineering perspective.

For the macroscale level problem we define a structural topology optimization problem that maximizes the minimum critical buckling load keeping the material volume constant [2].

For the microscale level problem, we consider an infinite and periodic structured medium for a given average (at the macroscale level) strain. Using the Floquet-Bloch wave theory only one cell is necessary in order to model also larger-than-one cell modes in the periodic medium, and thus also to obtain design sensitivities [1, 3]. Based on this theory we define a topology optimization problem, implicitly assuming repetitive cells, that maximize the minimum critical buckling strain while keeping the cell volume fraction constant.

The methodology developed has been tested and evaluated in several computational applications.

References

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