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Optimal Structures for Buckling Forces and Buckling Displacements

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The classical problem of optimal design of structures under stability constraints concerns mainly loadings controlled by a system of forces. However, in some practical engineering applications the loadings controlled by displacements can also occur. This type of problems is, for example, connected with structures under thermal loadings or in the case of assembly loadings. Then, the compressive forces depend on geometry of the structure,whereas in the classical optimization problem the forces are independent of the structure. Hence, the results of shape optimization can be qualitatively and quantitatively different for both types of loading control. In the paper optimal design of elastic structures under two types of loading control is considered and compared. Uni- and multimodal optimization of columns is considered as one-dimensional problem. The two-dimensional problem is represented by uni- and multimodal optimization of annular plates. Solutions were obtained by the Method of Moving Asymptotes and/or Simulated Annealing Method.

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