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Bi-Directional Evolutionary Topology Optimization Based on Critical Fatigue Constraint

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Abstract : This paper develops a method for considering the critical fatigue stress as a constraint in the Bi-directional Evolutionary Structural Optimization (BESO) method. Our aim is to reach an optimal design in which high cycle fatigue failure does not occur for a specific life time. The critical fatigue stress is calculated based on modified Goodman criteria and used as a stress constraint in our topology optimization problem. Since fatigue generally does not occur for compressive stresses, we use the p-norm approach of the stress measurement that considers the highest tensile principal stress in each point as stress measure to calculate the sensitivity numbers. The BESO method has been extended to minimize volume an object subjected to the critical fatigue stress constraint. The optimization results are compared with the results from the compliance minimization problem which shows clearly the merits of our newly developed approach.

Keywords : topology optimization, BESO method, p-norm, fatigue constraint
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