Holonomic Elastoplastic Truss Design Using Displacement Based Optimization

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(ABSTRACT)

A Displacement Based Optimization (DBO) approach was applied to truss design problems with material nonlinearities, to explore feasibility and verify efficiency of the approach to solve such problem. Various truss sizing problems with holonomic (path-independent) elastoplastic laws were investigated. This type of material nonlinearity allows us to naturally extend the linear elastic truss sizing in the DBO setting to nonlinear problems. A computer program that uses the commercially available optimizer DOT by VR&D and IMSL Linear Programming solver by Visual Numerics was developed to solve this type of problems. For comparison, we chose an important class of minimum-weight truss design problems, where holonomic linear strain hardening behavior was used. Additional examples of optimum design of trusses with elastic perfectly plastic material response that could be easily solved by Limit Design approach using linear programming were investigated for comparison. All demonstrated examples were tested successfully using the DBO approach. Solutions of comparable examples were consistent with the available results by other methods. Computational effort associated with the DBO approach was minimal for all the examples studied. Optimum solutions of several examples proved that the DBO approach is particularly suited for truss topology design where removal of truss members is essential.