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Summary: This work presents a level set-based approach to design multi-material compliant mechanisms subject to local stress constraints. The inclusion of stress constraints can avoid non-realistic hinges formed by a single node or element often present in compliant mechanisms. This study proposes an optimization procedure capable of assigning multiple materials with distinct properties along the structure to obtain mechanisms that maximize the output displacement and satisfy stress constraints. For the level set topology description, the Multi-Material Level Set (MM-LS) model is adopted. Local stress constraints and volume constraints for the multiple material phases are included in the objective function via an augmented Lagrangian technique. The structural geometry is defined by an explicit level set method and the Ersatz material model. The proposed approach is presented in a generalized form that can be easily extended to any number of materials defined by the user. Two-dimensional numerical results demonstrate the efficacy of the proposed procedure.

MSC:
74-XX Mechanics of deformable solids
90-XX Operations research, mathematical programming

Keywords:
topology optimization; stress constraints; level sets; multi-material; compliant mechanism

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References:
[10] Li, Y.; Xie, Y. M., Evolutionary topology optimization for structures made of multiple materials with different properties in tension and compression, Compos. Struct., 259, Article 113977 pp. (2021)


