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Design of Articulated Mechanisms with a Degree of Freedom Constraint Using Global Optimization

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This paper deals with design of articulated mechanisms using a truss ground structure representation. The considered mechanism design problem is to maximize the output displacement for a given input force by choosing a prescribed number of truss elements out of all the available elements, so that the resultant mechanism has one mechanical degree of freedom when supported in a statically determinate manner. The mechanical degree of freedom constraint is included since it is essential for obtaining a proper articulated mechanism design. The Green-Lagrange strain measure is used to accommodate for large displacements. The problem is formulated as a non-convex mixed integer problem and solved using a convergent deterministic global optimization method based on branch and bound with convex relaxations.

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