Numerical Investigation of Tensegrity Structures using Co-rotational Approach and Parametric Variational Principle

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Tensegrity structures composed of cables and struts usually exhibit strong nonlinear mechanical behaviors, in that large displacement motion and cable slack occur in the structures. A new efficient computational method is proposed to simulate the static responses of classical and clustered tensegrity structures. The co-rotational finite element formulation is used to describe the large rotation and the parametric variational principle is employed to deal with tension or slack of cables. The original nonlinear problem is finally evolved into a complementarity problem that can be easily solved by combing the Newton-Raphson scheme with the mature quadratic programming algorithm. The proposed method need not update the local stiffness matrix and improves the convergence of algorithm.

Keywords: Tensegrity structures, Clustered cables, Large displacement, Co-rotational approach, Parametric variational principle

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