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Abstract

Tensile structures in general, achieve their load-carrying capability only after the process of initial form-finding. From the mechanical point of view, this process can be considered as a problem in statics. As cable systems are close siblings of trusses (cables, however, can carry tensile forces only), in our study we refer to equilibrium equation similar to those known from the theory of the latter. In particular, the paper regards designing pre-tensioned cable systems, with a goal to make them kinematically stable and such that the weight of so designed system is lowest possible. Unlike in typical topology optimization problems, our goal is not to optimize the structural layout against a particular applied load. However, our method uses much the same pattern. First, we formulate the variational problem of form-finding and next we describe the corresponding iterative numerical procedure for determining the optimum location of nodes of the cable system mesh. We base our study on the concept of force density which is a ratio of an axial force in cable segment to its length.