



Mobility and stress analysis of highly symmetric generalized bar-and-joint structures

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This paper discusses the possibility of detecting mechanisms with second-order stiffness (resistance to the excitation of an infinitesimal mechanism) imposed by self-stresses in highly symmetric structures. Coupled application of symmetry adapted first-order matrix analysis and a second-order stiffness analysis is performed, then the symmetry adapted form of that second-order analysis is presented, specifying conditions under which the stiffening effect of multiple states of self-stress can be analyzed. Finally, a generalized bar-and-joint model containing new kinematic scalar constraints and variables is proposed, with respect to their applicability in symmetry adapted and second-order analyses. The results are illustrated on structural models of viruses in biology with icosahedral symmetry.

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