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Sensitivity Analysis Concerning the Initial Postbuckling Behavior of Elastic Structures

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The (initial) postbuckling behavior of imperfection-sensitive structures may be improved by converting them to imperfection-insensitive structures. Such a conversion can be achieved by specific modes of stiffening of the original structure. In this paper mathematical relations allowing to assess the sensitivity of the initial postbuckling behavior with respect to such modes of stiffening are presented. Koiter's initial postbuckling analysis is applied in the context of the Finite Element Method (FEM) to deduce these relations. An essential ingredient of a special form of accompanying linear eigenvalue analyses, previously used to compute estimates of stability limits on nonlinear primary paths, plays an important role in the derivation of these mathematical relations. They permit to determine whether or not a specific mode of stiffening will result in a transition from imperfection sensitivity to imperfection insensitivity. Two numerical examples serve as the vehicle to corroborate the theoretical findings.

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