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Assessment of the solution of the consistently linearized eigenproblem by means of finite difference approximations

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The so-called consistently linearized eigenproblem (CLE) has superb mathematical properties in the prebuckling regime and at the stability limit. Recently, Mang proposed a new concept of categorization of buckling of structures by means of spherical geometry. Herein, the CLE plays a pivotal role as a link between geometry and mechanics. Hence, it is essential to solve this eigenproblem efficiently and accurately, using the Finite Element Method (FEM) as the analysis tool. The coefficient matrix of the CLE contains the tangent stiffness matrix $\tilde{\mathbf{K}}_T$ and its first derivative with respect to the load parameter λ, denoted as $\dot{\tilde{\mathbf{K}}}_T$ and obtained from a finite difference approximation. The convergence rate and the accuracy of the relevant eigenvalue λ_1^* are investigated by means of comparison with an analytical result. A *von Mises* truss subjected to a vertical point load is analyzed. It serves the purpose of numerical verification of the efficiency and accuracy of the proposed approach.

Keywords: consistently linearized eigenproblem, finite difference approximation, finite element method, tangent stiffness matrix, *von Mises* truss