Model reduction is one method of choice to speed up the computation of finite element models in structural dynamics. This speed up is highly desired especially in design and optimization applications, where parametric models are considered and the outcoming high-dimensional problems must be solved multiple times. For systems which undergo large deflections, the equations of motion become nonlinear. In this case model reduction is applied in two steps: First, model order reduction applying a Galerkin projection is done, where a reduction basis is chosen to approximate the displacements as lower-dimensional linear combination of these basis vectors. Second, the nonlinear internal force term is hyperreduced, that speeds up its evaluation, which is essential to reduce computation time. The first step becomes challenging for parametric systems since the optimal reduction basis strongly depends on the parameter values. One approach is to update the reduction basis and subsequently reduce the system with the updated basis for each new parameter set of interest.
However, this approach can be very cost-intensive because in many algorithms for computation of reduction bases the parameter dependent tangential stiffness matrix must be decomposed in full dimension of the non-reduced system. This contribution shows how basis updating for geometrically nonlinear systems can be accelerated by using iterative solution techniques. An inverse-free preconditioned Krylov subspace method is applied to circumvent the decomposition of the updated tangential stiffness matrix to update the eigenmodes used as basis vectors. Additionally, the modal derivatives used to qualify the basis for nonlinear systems are updated by using a conjugate gradient algorithm.

Stichworte: Nonlinear Structural Dynamics; Parametric Model Reduction; Galerkin Projection; Basis Updating

Kongress- / Buchtitel: 89th Annual Meeting of GAMM 2018

Kongress / Zusatzinformationen: München, Germany

Ausgabe: 89

Ausrichter der Konferenz: Technische Universität München

Datum der Konferenz: 19.-23.03.2018

Publikationsdatum: 21.03.2018

Jahr: 2018

Quartal: 1. Quartal

Jahr / Monat: 2018-03

Monat: Mar

Revied: ja

Sprache: en

TUM Einrichtung: Lehrstuhl für Regelungstechnik; Lehrstuhl für Angewandte Mechanik

Occurences: Einrichtungen > Fakultäten > Fakultät für Maschinenwesen > Institut für Mechatronik > Lehrstuhl für Regelungstechnik (Prof. Lohmann) > 2018

entries: