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Structural damage detection of truss structure using mode shape data

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ABSTRACT

Damage detection methods can be classified into global and local approaches depending on the division of measurement locations in a structure. The former utilizes measurement data at all degrees of freedom (DOFs) for structural damage detection, while the latter utilizes data of members and substructures at a few DOFs. This paper presents a local method to detect damages by disassembling an entire structure into members. The constraint forces acting at the measured DOFs of mode shapes of the disassembled elements at the damaged state, and their internal stresses, are predicted. The proposed method detects locally damaged members of the entire structure by comparing the stress variations before and after damage. The mode shape-based local damage can be explicitly detected when it is positioned along the constraint load paths. The validity of the proposed method is illustrated through the damage detection of two truss structures, and the disassembling (i.e., local) and global approaches are compared using numerical examples. The numerical applications consider the noise effect and single and multiple damage cases, including vertical, diagonal, and chord members of truss structures.