**Full Title of the Paper**

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**ABSTRACT**

The following points should always be featured:

**Purpose:** This is where you explain “why” you undertook this study. If you are presenting new or novel research, explain the problem that you have solved. If you are building upon previous research, briefly explain why you felt it was important to do so. This is your opportunity to let readers know why you chose to study this topic or problem and its relevance. Let them know what your key argument or main finding is.

**Study design/methodology/approach:** This is “how” you did it. Let readers know exactly what you did to reach your results. For example, did you undertake interviews? Did you carry out an experiment in the lab? What tools, methods, protocols, or datasets did you use?

**Findings:** Here you can explain “what” you found during your study, whether it answers the problem you set out to explore, and whether your hypothesis was confirmed. You need to be very clear and direct and give exact figures, rather than generalize. It’s important not to exaggerate or create an expectation that your paper won’t fulfill.

**Originality/value:** This is your opportunity to provide readers with an analysis of the value of your results. It’s a good idea to ask colleagues whether your analysis is balanced and fair and again, it’s important not to exaggerate. You can also conjecture what future research steps could be.

The following three items should be included, if relevant to your paper or required by the journal you are submitting to:

* Research limitations/implications
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Follow the chronology of the paper, using headlines as guidelines if necessary. Make sure there is a consistent flow of information.

**Keywords:** Your submission should include up to five appropriate and short keywords that capture the principal topics of the paper. Please separate keywords by column.

**IMPORTANT NOTICE TO AUTHORS:** The subtitles in the structured abstract, i.e., purpose, study design/methodology/approach, findings, and originality/value, must be maintained. See next page for example abstract.

**Free vibration analysis and damage localization in tapered beams with cracks using finite element method**

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**ABSTRACT**

**Purpose:** A finite element model with two nodes and four degrees of freedom per node (horizontal and vertical translations, rotation, and curvature) is presented for free vibration analysis of damaged tapered beams.

**Study design/methodology/approach:** Stiffness and mass matrices for Bernoulli-Euler beams with variable cross-sections are derived by using the Galerkin method. In the finite element formulation, linear Lagrange polynomials for extensional vibrations and fifth-order Hermitian polynomials for bending vibrations are chosen. Damage is introduced using a stiffness loss coefficient to the element stiffness matrix. The mass matrix is assumed to be unchanged due to the damage effect.

**Findings:** The proposed element gives accurate results based on the comparisons with the available literature and ANSYS® finite element modal analysis results. Taper ratio and boundary conditions considerably affect the natural frequencies. Modal curvature changes are very successful in locating damages on the beam in comparison with the changes in mode shapes and modal slopes.

**Originality/value:** The finite element proposed in this study has very effective in determining the modal characteristics of tapered beams including multiple damages. Its results can be directly used to determine the crack locations very accurately since it provides the exact modal curvature values as a result of the eigenvalue problem.

**Keywords:** Tapered beam; Finite element method; Free vibration; Modal curvature

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