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# FREE VIBRATION AND DAMAGE DETECTION OF CRACKED BARS

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**Abstract:**
Free longitudinal vibration analysis of a cracked bar is considered as a prototype for analysis of cracked members. A new and efficient formulation for a multi cracked bar is developed. The previous solution of the problem is upgraded and an accurate and simple solution is proposed. It is shown that the transformation matrix method formulation can be developed with the help of the present work. Comparison of the transformation matrix method with the present method recommends the latter as a good replacement. For analysis of the eigen equations a new algorithm called the tangent length method is introduced. The algorithm computes the required number of frequencies in sequence. To prepare for numerical analysis the finite element formulation is developed. For determination of location and size of cracks a graphical and numerical method is used. The numerical method is based on the minimization of the error between the measured and computed frequencies in a least square sense. The optimization method (BFGS) is used for solution of the proposed problem. Through analysis of six examples the work is verified. It is concluded that the present formulation is accurate, efficient and simple method for analysis of free vibration of cracked bars. Moreover, it is a good replacement for the well known transformation matrix method.

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