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Letter to the Editor

A contribution on "Transverse vibration of an Euler–Bernoulli uniform beam on up to five resilient supports including ends"

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The need to analyze the vibration behavior of beams is of great importance in a number of branches of engineering, particularly in applications such as in the design of machines and structures. In this respect, the recent and relevant paper developed by Naguleswaran [1] furnishes a general method for the determination of the natural frequencies of Bernoulli–Euler beams with up to five resilient supports including ends. Additionally, several combinations of classical, degenerate and "general" types of resilient end supports were presented and finally, the tables of the first three frequencies for a selected set of system parameters permit further comparative studies.

On the other hand, it is interesting to note the existence of a previous study that, in the opinion of this author, should be cited. Fifty years ago, Lee and Saibel [2] developed a general expression from which the frequency equation for the vibration of a constrained beam with any combination of intermediate elastic or rigid supports, concentrated masses, and sprung masses can be found readily.

Essentially the method requires only the knowledge of the natural frequencies and natural modes of the beam supported at the ends in the same manner as the constrained beam but not subjected to any of the constraints between the ends. This method also was extended to find the natural frequencies of a beam on a continuous elastic foundation or under uniformly distributed loads of any length.

The methodology used is an extension of the method developed earlier for the solution of the natural frequencies of continuous beam [3] and the research was partially supported by funds from a U.S. Army Air Force contract with the Carnegie Institute of Technology, and was done in part by Lee in partial fulfillment of the requirements for the degree of Doctor of Sciences.

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Furthermore, with regard to previous works in which the Fourier series solution is applied, other references should be mentioned. Greif and Mittendorf [4] presented a method for vibration analysis of a wide class of beam, plate and shell problems including the effects of variable geometry and material properties. The method is based on the discrete technique of component mode analysis where the mode shapes for each of these components are written in terms of Rayleigh–Ritz expansions involving simple Fourier sine or cosine series.

In 1977 the same authors showed [5] that a single segment guided–guided beam, coupled with a sine series, is sufficient to derive an exact master frequency determinant for a general multi-segmented beam with arbitrary material and geometric properties in each segment and general boundary conditions at the ends. The procedure may also be done with a cosine series expansion of the modes. The basic single element appropriate to this case is the familiar simply supported beam and is sufficient to derive an exact master frequency determinant for the general beam problem [5,6]. In this technique, it is quite simple to include the effects of springs and discrete masses at intermediate points and boundaries. Of course, it is dependent on the nature of the vibration problem analyzed.

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