Available online at www.sciencedirect.com
SCIENCE DIRECT®
Journal of Sound and Vibration 275 (2004) 459–460
JOURNAL OF SOUND AND VIBRATION
www.elsevier.com/locate/jsvi

Letter to the Editor

# Comments on "A dynamical basis for computing the modes of Euler–Bernoulli and Timoshenko beams"

J.R. Banerjee*

*School of Engineering and Mathematical Sciences, City University, Northampton Square, London EC1V 0HB, UK*

Received 23 June 2003

The authors of Ref. [1] have given a dynamical basis for computing the modes of Euler–Bernoulli and Timoshenko beams. The formulation for both of the beam models has been presented by one differential equation (see Eq. (3)) using the terms $g^2$ and $a^4$ which are defined in Table 1. The solution follows from the characteristic equation (7) which applies to both the Euler–Bernoulli and Timoshenko beams. Apparently the authors of the article have overlooked an important fact somehow obscured in the article, which devalues their work.

It is clear from Table 1 that the value of $a^4$ for the Euler–Bernoulli beam will be always positive for all physical problems. However, the same cannot be said for the Timoshenko beam model for which $a^4$ can be positive, zero or negative, although the latter two cases occur only at exceptionally high frequencies. Unfortunately, the authors have assumed that $a^4$ is always positive in the Timoshenko beam solution and have limited their investigation by providing only one set of the solution. This may not strike a chord with many readers, particularly against the background that a number of articles dealing with the second spectrum of Timoshenko beam natural frequencies has appeared in the Journal of Sound and Vibration in recent years.

Clearly, a negative value of $a^4$ in Eq. (7) of Ref. [1] will yield all four roots of $\lambda$ imaginary (see Eq. (8)). This will change the expression for $\varphi$ which denotes the spectral basis for the solution. The authors of Ref. [1] have included the effect of an axial force in the formulation of the Euler-Bernoulli beam model, but unfortunately, they have excluded this effect for the Timoshenko beam problem. Given the fact that the governing differential equation of motion of an *axially loaded* Timoshenko beam is readily available in the literature [2,3], it is a huge pity that the authors have ignored this important effect.

## References

[1] J.R. Claeyssen, R.A. Soder, A dynamical basis for computing the modes of Euler–Bernoulli and Timeshenko beams, *Journal of Sound and Vibration* 259 (4) (2003) 986–990.

*Corresponding author. Tel.: +44-20-7040-8924; fax: +44-20-7040-8566.
*E-mail address:* j.r.banerjee@city.ac.uk (J.R. Banerjee).

0022-460X/$ - see front matter 
doi:10.1016/j.jsv.2003.10.023

[2] F.Y. Cheng, W.H. Tseng, Dynamic matrix of Timoshenko beam columns, *Journal of the Structural Division, ASCE* 99 (ST3) (1973) 527–549.

[3] W.P. Howson, F.W. Williams, Natural frequencies of frames with axially loaded Timoshenko members, *Journal of Sound and Vibration* 26 (4) (1973) 503–515.