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Letter to the Editor

Comments on "On the eigenfrequencies of a two-part beam-mass system"

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In a recent article, on the eigenfrequencies of a two-part beam–mass system, Kopmaz and Telli [1] have presented the determinantal frequency equation and results for an Euler–Bernoulli beam carrying a rigid body. This writer has been using a similar but slightly different problem to illustrate the modal behaviour of transversely vibrating beams in an undergraduate course for the past 5 years [2]. It is slightly different in the sense that the centre of mass of the attached body is not necessarily at its mid-point. To illustrate the modal behaviour of the system, this writer also developed an interactive computer program in 1998 that is freely available on the worldwide web [3]. Kopmaz and Telli [1] presented their results in graphical form only, and if the readers wish to compute the natural frequencies for specific cases and view the modes, the interactive program may be used to generate these.

This writer notes that in Eq. (10), p. 372 of Ref. [1], there are no terms associated with the shear force at the beam boundaries. These terms would give rise to moments about the centroid due to the eccentricity. Equation (10) should read:

$$-E_1I_1y_1''(a,t)+E_2I_2y_2''(c,t)-E_1I_1y_1'''(a,t)\left(\frac{b}{2}\right)+E_2I_2y_2'''(c,t)\left(\frac{b}{2}\right)=J\ddot{y}_1'(a,t).$$

Since numerical results were not published, this writer was unable to check whether this was just a typing omission or a mistake in the analysis. This omission would not make any difference to the results for the frequencies corresponding to the symmetrical modes of a symmetrical structure, as the rigid body has no rotation.

If the mass centre of the rigid body were located at distance e_1 from the left beam (see Fig. 1), the equations of motion for the body would change to

$$E_1I_1y_1'''(a,t)+E_2I_2y_2'''(c,t)=M\left[\ddot{y}_1(a,t)+e_1\ddot{y}_1'(a,t)\right],$$

$$-E_1I_1y_1''(a,t)+E_2I_2y_2''(c,t)-E_1I_1y_1'''(a,t)e_1+E_2I_2y_2'''(c,t)(b-e_1)=J\ddot{y}_1'(a,t).$$

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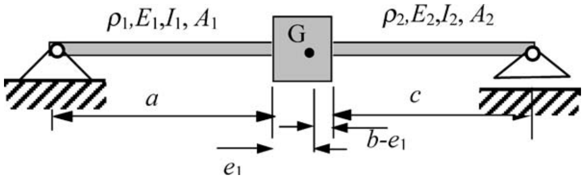

Fig. 1. Two-part beam–mass system.

The interactive program in Ref. [3] may be used to generate results for the case where e_1 is not necessarily equal to $b/2$. The notation used in the program is different but is explained there.

References

[1] O. Kopmaz, S. Telli, On the eigenfrequencies of a two-part beam–mass system, Journal of Sound and Vibration 252 (2) (2002) 370–384.

[2] S. Ilanko, Vibration and stability of structural elements, Lecture Notes for ENME432: Mechanics of Vibration, University of Canterbury, New Zealand, 1998.

[3] S. Ilanko, 2000, Vibration Research Resources Page, www.geocities.com/ilanko/vibration.htm.