Journal of Sound and Vibration (2000) **235**(5), 877–878
doi:10.1006/jsvi.1999.2711, available online at http://www.idealibrary.com on IDEAL®

COMMENT ON "NON-LINEAR VIBRATION ANALYSIS OF A TRAVELLING STRING WITH TIME-DEPENDENT LENGTH BY NEW HYBRID LAPLACE TRANSFORM/FINITE ELEMENT METHOD"

A. Y. T. LEUNG

School of Engineering, University of Manchester, M13 9PL, England

(*Received* 1 *September* 1999)

The authors of reference [1] solved the Laplace transformed equation (20) below

$$(s^2\mathbf{M} + s\mathbf{C} + \mathbf{K})\bar{\mathbf{Q}} = \mathbf{f} \tag{20}$$

by three consecutive similarity transformations to make the symmetric square matrices **M**, **C** and **K** diagonal for the inverse Laplace transform. The first transformation is

$$\bar{\mathbf{Q}} = \mathbf{R}\bar{\mathbf{Q}}^{(1)}, \tag{23}$$

so that equation (20) becomes

$$(s^2\mathbf{I} + s\mathbf{T} + \mathbf{G})\bar{\mathbf{Q}}^{(1)} = \mathbf{f}^{(1)}. \tag{24}$$

The second transformation is

$$\bar{\mathbf{Q}}^{(1)} = \mathbf{P}\bar{\mathbf{Q}}^{(2)}, \quad \mathbf{P}^{\mathrm{T}}\mathbf{P} = \mathbf{I}, \tag{25}$$

so that equation (24) becomes

$$(s^2\mathbf{I} + s\mathbf{T}_1 + \boldsymbol{\kappa})\bar{\mathbf{Q}}^{(2)} = \mathbf{f}^{(2)}, \tag{26}$$

where $\boldsymbol{\kappa} = diag[\kappa_i : i = , \ldots, n]$ and $\mathbf{T}_1$ is a full symmetric matrix. The third transformation is

$$\bar{\mathbf{Q}}^{(2)} = \mathbf{W}\bar{\mathbf{Q}}^{(3)}, \quad \mathbf{W}^{\mathrm{T}}\mathbf{W} = \mathbf{I},$$

so that equation (26) becomes

$$(s^2\mathbf{I} + s\boldsymbol{\beta} + \lambda)\bar{\mathbf{Q}}^{(3)} = \mathbf{f}^{(3)}, \tag{27}$$

where all matrices are diagonal, $\boldsymbol{\beta} = diag[\beta_i : i = 1, \ldots, n]$ and $\boldsymbol{\lambda} = diag[\lambda_i : i, \ldots, n]$. A serious mistake is to claim that the orthogonal transformation of a diagonal matrix is still a diagonal matrix, i.e., $\mathbf{W}^{\mathrm{T}}\boldsymbol{\kappa}\mathbf{W} = \boldsymbol{\lambda}$. For the sake of argument, let

$$\mathbf{W} = \frac{1}{\sqrt{2}}\begin{bmatrix} 1 & -1 \\ 1 & 1 \end{bmatrix}, \quad \boldsymbol{\kappa} = diag[1, 2] \quad \text{and} \quad \boldsymbol{\lambda} = \begin{bmatrix} 3 & -1 \\ -1 & 3 \end{bmatrix},$$

which is not diagonal. Therefore, the subsequent decoupled inverse Laplace transform is not possible.

0022-460X/00/350877 + 00 $35.00/0

REFERENCE

1. C. M. YAO, R. F. FUNG and C. R. TSENG 1999 *Journal of Sound and Vibration* **219**, 323–337. Nonlinear vibration analysis of a travelling string with time-dependent length by new hybrid Laplace transformation/finite element method.

doi:10.1006/jsvi.1999.2712, available online at http://www.idealibrary.com on IDEAL®

AUTHOR'S REPLY

R. F. FUNG

Department of Mechanical Engineering, Chung Yuan Christian University, Chung-Li, Taiwan 32023, *R. O. C.*

(*Received* 12 *October* 1999)

The comment made by Professor Leung is correct. The numerical results of examples 1 and 2 as shown in Figures 2 and 3, respectively, are still correct for the stationary string system [1], since the damping terms are ignored in equations (42) and (46).

REFERENCES

1. C. M. YAO, R. F. FUNG and C. R. TSENG 1999 *Journal of Sound and Vibration* **219**, 323–337. Non-linear vibration analysis of a travelling string with time-dependent length by new hybrid Laplace transform/finite element method.