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ERRATA

C.-N. Chen 2000 *Journal of Sound and Vibration* **230**, 241–260. Dynamic equilibrium equations of non-prismatic beams defined on an arbitrarily selected co-ordinate system.

In this paper, equation (31) and the text equation need a correction. As stated in the paper, if two degrees of freedom used to represent Φ and $\mathrm{d}\Phi/\mathrm{d}\zeta$ are assigned to a node, the EQD can adopt the Hermite polynomial as the interpolation functions to define the weighting coefficients. For this model, the variable function is approximated by

$$\Phi(\zeta) = \sum_{p=1}^{N_N} H_p(\zeta)\Phi_p + \sum_{p=1}^{N_N} \tilde{H}_p(\zeta)\frac{\mathrm{d}\Phi_p}{\mathrm{d}\zeta}, \tag{31}$$

where

$$H_p(\zeta) = \left[1 - 2(\zeta - \zeta_p)\frac{\mathrm{d}L_p(\zeta_p)}{\mathrm{d}\zeta}\right] L_p^2(\zeta)$$

and $\tilde{H}_p(\zeta) = (\zeta - \zeta_p)L_p^2(\zeta)$ are Hermite polynomials, and

$$L_p(\zeta) = \prod_{q=1, q\neq p}^{N_N} \frac{(\zeta - \zeta_q)}{(\zeta_p - \zeta_q)}, \quad p = 1, 2, \ldots, N_N.$$

Then the following relation can be defined:

$$\frac{\mathrm{d}\phi}{\mathrm{d}\zeta}|_r = \sum_{\gamma=1}^{N_N} \frac{\mathrm{d}H_\gamma}{\mathrm{d}\zeta}|_r \Phi_\gamma + \sum_{\gamma=1}^{N_N} \frac{\mathrm{d}\tilde{H}_\gamma}{\mathrm{d}\zeta}|_r \frac{\mathrm{d}\Phi_\gamma}{\mathrm{d}\zeta} = \sum_{\gamma=1}^{N_N} \bar{D}_{r\gamma}^{\zeta}\Phi_\gamma + \sum_{\gamma=1}^{N_N} \tilde{D}_{r\gamma}^{\zeta}\frac{\mathrm{d}\Phi_\gamma}{\mathrm{d}\zeta}, \tag{32}$$

where

$$\bar{D}_{r\gamma}^{\zeta} = 2L_\gamma(\zeta_r)\{[1 - 2(\zeta_r - \zeta_\gamma)L_{\gamma,\zeta}(\zeta_\gamma)]L_{\gamma,\zeta}(\zeta_r) - L_{\gamma,\zeta}(\zeta_\gamma)L_\gamma(\zeta_r)\}$$

and

$$\tilde{D}_{r\gamma}^{\zeta} = L_\gamma(\zeta_r)[L_\gamma(\zeta_r) + 2(\zeta_r - \zeta_\gamma)L_{\gamma,\zeta}(\zeta_r)].$$

Then the weighting coefficient $D_{r\gamma}^{\zeta}$ defined by Hermite polynomials, with the range of r and s being $2N_N$, can be formed by using the elements of $\bar{D}_{r\gamma}^{\zeta}$ and $\tilde{D}_{r\gamma}^{\zeta}$. The weighting coefficients for higher order derivatives can similarly be calculated. The method of directly substituting analytical functions $r_p(\zeta)$ into the EDQ defined equation (27) and the method of nodal constraint starting from equation (29) can be used to calculate weighting coefficients by adopting general analytical functions such as Chebyshev polynomials, Bernoulli polynomials, Euler polynomials, etc. However, by using these two methods the solution of linear algebraic systems is required.

Regarding the solution of free vibration problem by DQEM, the overall discrete eigenvalue equation system considering kinematic boundary conditions can be expressed as

$$([K] = \omega^2[M])\{D\} = \{0\}, \tag{33}$$

where $[K]$ is the overall stiffness matrix, $[M]$ the overall mass matrix and $\{D\}$ the overall model displacement vector. $[K]$ is sparse. $[M]$ is a diagonal matrix with zeros appearing

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on-diagonal. It is positive semidefinite. Equation (33) is a generalized eigenvalue problem with infinite frequencies existing. Premultiplication of equation (33) by $[K]^{-1}$ leads to

$$([A] - \lambda[I])\{D\} = \{0\}, \tag{34}$$

where $[A] = [K]^{-1}[M]$ and $\lambda = 1/\omega^2$. Equation (34) can be solved by using either an exact solution technique or an approximate solution technique. If the order of the eigenvalue system is large, the approximation algorithms which calculate the eigenpairs in descending order can reduce the expense.

Some d.o.f. can be eliminated before solving equation (33). If no mass is attached to an inter-element boundary or natural boundary, the displacement parameters associated with it can be eliminated. Considering the non-existence of inertia forces for some component equations existing in equation (33), the equation can be rewritten as

$$\left(\begin{bmatrix} [K_{aa}] & [K_{ab}] \\ [K_{ba}] & [K_{bb}] \end{bmatrix} - \omega^2 \begin{bmatrix} [M_{aa}] & [0] \\ [0] & [0] \end{bmatrix}\right) \begin{Bmatrix} \{D_a\} \\ \{D_b\} \end{Bmatrix} = \begin{Bmatrix} \{0\} \\ \{0\} \end{Bmatrix} \tag{35}$$

with $[M_{aa}]$ a diagonal matrix without zeros appearing on-diagonal. From the lower part of equation (35), the following relation can be obtained:

$$\{D_b\} = [K_{bb}]^{-1}[K_{ba}]\{D_a\}. \tag{36}$$

The substitution of equation (36) into the upper part of equation (35) yields

$$([\bar{K}_{aa}] - \omega^2[M_{aa}])\{D_a\} = \{0\}, \tag{37}$$

where

$$[\bar{K}_{aa}] = [K_{aa}] + [K_{ab}][K_{bb}]^{-1}[K_{ba}]. \tag{38}$$

Equation (37) can be treated and solved by the same procedure that transfers equation (33) into equation (34). It can be solved by adopting the advantage of the diagonality of $[M_{aa}]$. Defining $[M_{aa}] = [L]^2$ and $\{D_a\} = [L]^{-1}\{Y\}$, substituting them into equation (37), and then premultiplying by $[L]^{-1}$, the following eigenvalue problem can be obtained:

$$([H] - \omega^2[I])\{Y\} = \{0\}, \tag{39}$$

where $[H] = [L]^{-1}[\bar{K}_{aa}][L]^{-1}$. For economically solving a large eigenvalue problem, the approximation algorithms which calculate the eigenpairs in ascending order can be used.