سلام

ببخشید من برنامه ای میخواستم که دستگاه معادله دیفرانسیل زیر را حل کنه :

5 معادله دیفرانسیل-5مجهول

مجهولات دستگاه معادله :

$$U, V, W, \Psi_x, \Psi_\theta$$

بقیه ضرایب معلوم هستند. ضمنا جملاتی که دارای مشتق به زمان هستند(جملات دارای t) حذف میشوند.در حقیقت طرف دوم معادلات صفر در نظر گرفته می شود.

معادلات:

$$\begin{aligned}
&B_{11}(u_{,xx} - u_{,x}) + B_{12}\left(-\frac{1}{\sin(\alpha)}\nu_{,\theta} + \frac{1}{\sin(\alpha)}\nu_{,x\theta} + \frac{1}{\tan(\alpha)}w_{,x} - \frac{1}{\sin(\alpha)}w\right) \\
&\quad + C_{11}(\psi_{x,xx} - \psi_{x,x}) + C_{12}\left(-\frac{1}{\sin(\alpha)}\psi_{\theta,\theta} + \frac{1}{\sin(\alpha)}\psi_{\theta,\theta x} + \psi_{x,x} - \psi_{x}\right) \\
&\quad + \frac{1}{\sin(\alpha)}B_{33}\left(\nu_{,\theta x} + \frac{1}{\sin(\alpha)}u_{,\theta\theta}\right)\frac{1}{\sin(\alpha)}C_{33}\left(\psi_{\theta,\theta x} + \frac{1}{\sin(\alpha)}\psi_{x,\theta\theta} - \psi_{\theta,\theta}\right) \\
&\quad = S_1^2 e^{2x}(I_1 u_{,tt} - I_2 \psi_{x,tt}), \\
&\frac{1}{\sin(\alpha)}B_{21}u_{,\theta x} + B_{22}\left(\frac{1}{\sin(\alpha)}\nu_{,\theta\theta} + \frac{1}{\tan(\alpha)}w_{,\theta}\right) \\
&\quad + B_{33}\left(\nu_{,xx} - \nu_{,x} - \frac{1}{\sin(\alpha)}u_{,\theta} + \frac{1}{\sin(\alpha)}v_{,x\theta}\right)C_{21}\psi_{x,\theta x} \\
&\quad + C_{22}\left(\frac{1}{\sin(\alpha)}\psi_{\theta,\theta\theta} + \psi_{x,\theta}\right) + C_{33}\left(\psi_{\theta,xx} - 2\psi_{\theta,x} - \frac{1}{\sin(\alpha)}\psi_{x,x\theta} + \psi_{\theta}\right) \\
&\quad = S_1^2 e^{2x}(I_1 \nu_{,tt} + I_2 \psi_{\theta,tt}),
\end{aligned}$$

$$
\begin{aligned}
&C_{11}(u_{,xx} - u_{,x}) + C_{12}\left(-\frac{1}{\sin(\alpha)}\nu_{,\theta} + \frac{1}{\sin(\alpha)}\nu_{,\theta x} + \frac{w_{,x}}{\tan(\alpha)} - \frac{w}{\tan(\alpha)}\right) \\
&\quad + D_{11}(\psi_{x,xx} - \psi_{x,x}) + D_{12}\left(-\frac{1}{\sin(\alpha)}\psi_{\theta,\theta} + \frac{1}{\sin(\alpha)}\psi_{\theta,\theta x} + \psi_{x,x} - \psi_x\right) \\
&\quad + \frac{1}{\sin(\alpha)}C_{33}\left(\nu_{,\theta x} + \frac{1}{\sin(\alpha)}u_{,\theta\theta}\right) \\
&\quad + \frac{1}{\sin(\alpha)}D_{33}\left(\psi_{\theta,\theta x} + \frac{1}{\sin(\alpha)}\psi_{x,\theta\theta} - \psi_{\theta,\theta}\right) - B_{77}(w_{,x} + S_1 e^{x}\psi_x) \\
&\quad = S_1^2 e^{2x}(I_2 u_{,tt} + I_3 \psi_{x,tt}), \\
&\frac{1}{\sin(\alpha)}C_{12}(u_{,x\theta} - u_{,x}) + C_{22}\left(\frac{1}{\sin(\alpha)}\nu_{,\theta\theta} + \frac{1}{\tan(\alpha)}w_{,\theta}\right) + \frac{1}{\sin(\alpha)}D_{12}\psi_{x,x\theta} \\
&\quad + \frac{1}{\sin(\alpha)}D_{22}\left(\frac{1}{\sin(\alpha)}\psi_{\theta,\theta\theta} + \psi_{x,\theta}\right) \\
&\quad + \frac{1}{\sin(\alpha)}C_{33}\left(\nu_{,xx} - \frac{1}{\sin(\alpha)}\nu_{,x} - \frac{1}{\sin(\alpha)}u_{,\theta} + \frac{1}{\sin(\alpha)}\psi_x\right) \\
&\quad + \frac{1}{\sin(\alpha)}D_{33}\left(\psi_{\theta,xx} - 2\psi_{\theta,x} - \frac{1}{\sin(\alpha)}\psi_{x,\theta} + \frac{1}{\sin(\alpha)}\psi_{\theta,x\theta} + \psi_\theta\right) \\
&\quad = S_1^2 e^{2x}(I_2 \nu_{,tt} + I_3 \psi_{\theta,tt}), \\
&\frac{1}{\sin(\alpha)}\left(B_{12}u_{,x} + B_{22}\left(\frac{1}{\sin(\alpha)}\nu_{,\theta} + \frac{1}{\tan(\alpha)}w\right) + C_{12}\psi_{x,x}\right. \\
&\quad \left. + C_{22}\left(\frac{1}{\sin(\alpha)}\psi_{\theta,\theta} + \frac{1}{\tan(\alpha)}\psi_x\right)\right) + B_{77}(w_{,xx} - w_{,x} + \psi_{x,x}) \\
&\quad + \frac{1}{\sin(\alpha)}B_{88}\left(\frac{1}{\sin(\alpha)}w_{,\theta\theta} + \psi_{\theta,\theta}\right) \\
&\quad = S_1^2 e^{2x} I_1 w_{,tt},
\end{aligned}
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خود مقاله راه زیر و شرایط مرزی زیر را هم گفته:

$$(U, V, W, \Psi_x, \Psi_\theta) = \sum_{mn} (U_{mn} X_{,x} Y, V_{mn} X Y_{,\theta}, W_{mn} X Y, \Psi^x_{mn} X Y_{,\theta}, \Psi^\theta_{mn} X Y),$$

where U_{mn}, V_{mn}, W_{mn}, Ψ^x_{mn} are Ψ^θ_{mn} are the unknown functions of time. The functions X and Y are continuous orthonormed functions, which satisfy at least the geometric boundary conditions, and represent approximate shapes of the deflected surface of the vibrating shell. These functions, for different cases of boundary conditions are given as [Fares *et al.*, 2014]

For simply–simply supported:

$$X = \sin \mu_m x, \quad \mu_m = m\pi/L, \quad Y = \cos n\theta.$$

For the clamped–clamped boundary:

$$X = \sin \mu_m x, -\sinh \mu_m x - \eta_m (\cos \mu_m x, -\cosh \mu_m x), \quad Y = \cos n\theta,$$

$$\eta_m = (\sin \mu_m L - \sinh \mu_m L)/(\cos \mu_m L - \cosh \mu_m L), \quad \mu_m = (m + 0.5)\pi/L.$$

For the clamped-free boundary:

$$X = \sin \mu_m x, -\sinh \mu_m x - \eta_m (\cos \mu_m x, -\cosh \mu_m x), \quad Y = \cos n\theta,$$

$$\eta_m = (\sin \mu_m L + \sinh \mu_m L)/(\cos \mu_m L + \cosh \mu_m L)^{-1}, \quad \mu_m = (m + 0.5)\,\pi/L.$$

Consequently

For simply–simply supported

$$\nu = w = N_x = M_x = M_{x\theta} = 0.$$

For the clamped boundary

$$u = \nu = w = \Psi_x = M_{x\theta} = 0.$$

For the clamped-free boundary

$$u = \nu = w = \Psi_x = M_{x\theta} = 0 \quad \text{at } x = 0 \quad \text{and}$$

$$N_x = N_{x\theta} = Q_x = M_x = M_{x\theta} = 0 \quad \text{at } x = L.$$

The general displacements fields for circular composite lattice conical shell and any circumferential and axial wave numbers n and m respectively can defined as

$$u(x,\theta,t) = U_{mn}(x)\cos(\eta\theta)\cos(\omega t), \quad \nu(x,\theta,t) = V_{mn}(x)\sin(\eta\theta)\cos(\omega t),$$
$$w(x,\theta,t) = W_{mn}(x)\cos(\eta\theta)\cos(\omega t), \tag{27}$$
$$\psi_x(x,\theta,t) = \Psi^x_{mn}(x)\cos(\eta\theta)\cos(\omega t), \quad \psi_\theta(x,\theta,t) = \Psi^\theta_{mn}(x)\cos(\eta\theta)\cos(\omega t),$$

where ω is the natural frequency and $U(x), V(x), W(x)$, $\Psi_x(x)$ and $\Psi_\theta(x)$ are the axial modal functions. The crucial part of the analysis involves choosing appropriate series forms for these mode functions. The series should be simple in form and at the same time preserve orthogonality properties. The set of Fourier series in (27) and (28) represents the exact solution of the shell which satisfies the boundary conditions of a with simply-supported ends shell with no axial constraint (SNA–SNA) term-by-term [Hemmatnezhad *et al.*, 2014].

$$U_{mn}(x) = U_{0n} + \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} U_{mn}\cos(\lambda x), \quad V_{mn}(x) = \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} V_{mn}\sin(\lambda x),$$
$$W_{mn}(x) = \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} W_{mn}\sin(\lambda x), \quad \Psi^x_{mn}(x) = \Psi^1_{0n} + \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} \Psi^1_{mn}\cos(\lambda x), \tag{28}$$
$$\Psi^\theta_{mn}(x) = \sum_{m=1}^{\infty}\sum_{n=1}^{\infty} \Psi^2_{mn}\sin(\lambda x),$$

where

$$\lambda = \frac{m\pi}{x_0}; \quad \eta = \frac{n}{\sin(\alpha)}. \tag{29}$$