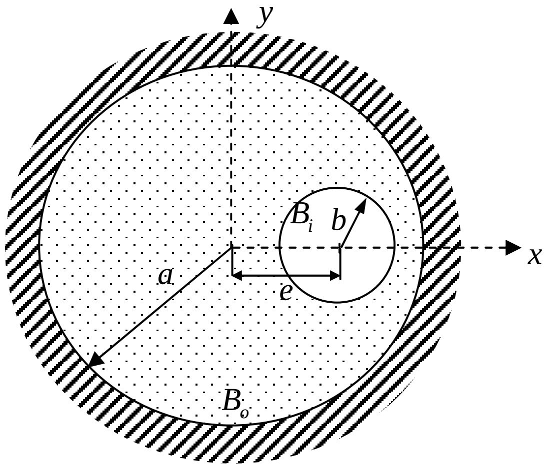
程式 107 Vibration of plate with eccentric hole

Governing equation: $\nabla^4 u(x) = \lambda^4 u(x), \quad x \in \Omega$

Boundary conditions: $u(x)\big|_{x\in B_o} = 0$, $\theta(x)\big|_{x\in B_o} = 0$, $m(x)\big|_{x\in B_i} = 0$, $v(x)\big|_{x\in B_i} = 0$

$b/a = 0.25$



Degenerate kernel:

$$U^I(R,\theta;\rho,\phi) = \sum_{m=-\infty}^{\infty} \frac{1}{8\lambda^2}\{J_m(\lambda\rho)[Y_m(\lambda R) - iJ_m(\lambda R)] + \frac{2}{\pi}(-1)^m I_m(\lambda\rho)[(-1)^m K_m(\lambda R) - iI_m(\lambda R)]\}\cos(m(\theta-\phi)),\ R > \rho,$$

$$U^E(R,\theta;\rho,\phi) = \sum_{m=-\infty}^{\infty} \frac{1}{8\lambda^2}\{J_m(\lambda R)[Y_m(\lambda\rho) - iJ_m(\lambda\rho)] + \frac{2}{\pi}(-1)^m I_m(\lambda R)[(-1)^m K_m(\lambda\rho) - iI_m(\lambda\rho)]\}\cos(m(\theta-\phi)),\ R < \rho$$

Results

	FEM [1]		BIEM	
e/a	Mode shapes	Frequency β^2	Mode shapes	Frequency β^2
0.0			—	—
0.15			—	—
0.30			—	—
0.45			—	—
0.60			—	—

where $\beta^2 = \omega a^2 \sqrt{\gamma t / gD}$ and ω, g, γ, t and D are circular frequency, acceleration of gravity, density, thickness and flexural rigidity of the plate.

【Reference】

[1] H. B. Khurasia and S. Rawtani (1978) Vibration Analysis of Circular Plates with Eccentric hole, Journal of Applied Mechanics, Vol. 45, pp. 215-217.