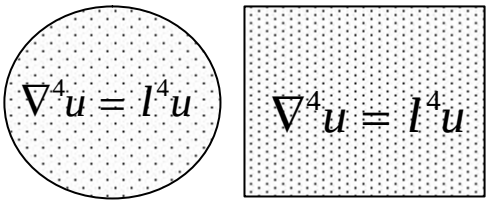
程式 52　Meshless method (Plate vibration)

Meshless formulation for simply-supported plate vibration

$$\nabla^4 u(x) = l^4 u(x), \quad x \in D$$
$$u(x) = 0, \quad x \in B$$
$$m(x) = n\,\nabla^2(u(x)) + (1-n)\frac{\partial^2(u(x))}{\partial n^2} = 0, \quad x \in B$$



where $l^4 = \dfrac{w^2 r h}{D}$, $D = \dfrac{Eh^3}{12(1-n)}$

1. Circular case

Analytical study using circulants

SVD updating techniques

True and Spurious eigenvalues

Numerical experiment

2. Square case

Numerical experiment

$U(s,x) = \mathrm{Im}\{U_c(s,x)\}$, (1) $U_c(s,x) = -\dfrac{i}{8l^2}\{H_0^{(1)}(lr) - H_0^{(1)}(ilr)\}$ (*Kitahara*)

(2) $U_c(s,x) = \mathrm{Re}\{-\dfrac{i}{8l^2}\{H_0^{(1)}(lr) - H_0^{(1)}(ilr)\}\}$ (*Hutchinson*)

(3) $U_c(s,x) = AJ_0(lr) + BI_0(lr)$ (*Kang*)

3. Meshless formulation

4. Determination of eigenvalues and eigenmodes

5. Exact solution：

$\dfrac{J_{n+1}(l)}{J_n(l)} + \dfrac{I_{n+1}(l)}{I_n(l)} = \dfrac{2l}{1-n}$, for simply-supported circular plate

$l_{ij} = p\sqrt{i^2 + j^2(\dfrac{a}{b})^2}$, for simply-supported rectangular plate

6. Spurious eigenvalues by using single and double layer potential methods

Reference

1. Y. T. Lee, I. L. Chen, K. H. Chen and J. T. Chen, A new meshless method for free vibration analysis of plates using radial basis function. The 26th National Conference on Theoretical and Applied Mechanics, Hu-Wei, Taiwan, R. O. C., 2002.

2. J. T Chen, I. L. Chen, K. H. Chen and Y. T. Lee, Comments on "Free vibration analysis of arbitrarily shaped plates with clmped edges using wave-type function". Journal of Sound and Vibration, Vol.262, pp.370-378, 2003.

3. J. T. Chen, I. L. Chen, K. H. Chen, Y. T. Lee and Y. T. Yeh, A meshless method for free vibration analysis of circular and rectangular clamped plates using radial basis function. Engineering Analysis with Boundary Elements, In Press.