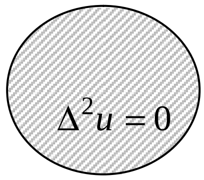
程式 82 Degenerate scale for biharmonic operator

Example 1:

G. E.: $\Delta^2 u = 0$

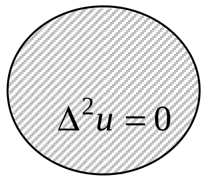


B. C.: $\begin{cases} u = x^4 - y^4 \\ \dfrac{\partial u}{\partial n} = 4(x^3 n_x - y^3 n_y) \end{cases}$

Exact solution: $u(x, y) = x^4 - y^4$

Example 2:

G. E.: $\Delta^2 u = 0$

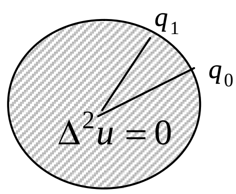


B. C.: $\begin{cases} u = \dfrac{-1}{4} \\ \dfrac{\partial u}{\partial n} = \dfrac{-1}{2}(1+\cos q) \end{cases}$

Exact solution: $u(r,q) = \dfrac{1}{4}(1-r^2)(1+r\cos q) - \dfrac{1}{4}$

Example 3:

G. E.: $\Delta^2 u = 0$



B. C.: $\begin{cases} u = 0 \\ \dfrac{\partial u}{\partial n} = \begin{cases} -1, & q_0 < q < q_1 \\ 0, & q_1 < q < 2p + q_0 \end{cases} \end{cases}$

Exact solution: $u(r,q) = \dfrac{1}{2p}(1-r^2)[g + \arctan(\dfrac{1+r}{1-r}\tan\dfrac{q_1 - q}{2}) - \arctan(\dfrac{1+r}{1-r}\tan\dfrac{q_0 - q}{2})]$

where $g = \begin{cases} 0, & q_1 - p < q < q_0 + p \\ p, & q_0 + p < q < q_1 + p \end{cases}$

By using the null-field integral equations in conjunction with the degenerate kernels and Fourier series, derive the analytical solution.

Reference:

1. Yiorgos-Sokratis, Smyrlis & Andreas Karageorphis, 2003, Some aspects of the method of fundamental solutions for certain biharmonic problems, CMES, Vol. 4, No. 5, pp. 535-550.
2. Mills R. D., 1977, Computing internal viscous flow problems for the circle by integral methods, J. Fluid Mech., Vol.12, pp.609-624.

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