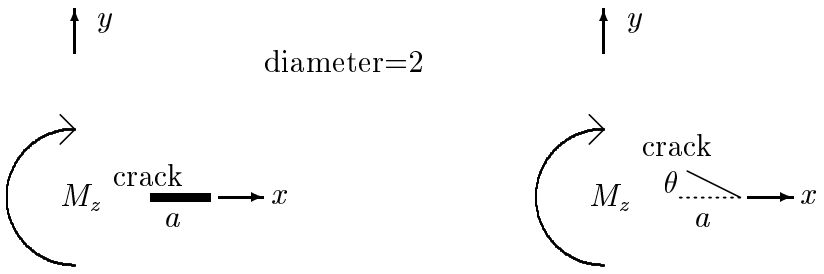
程式26 Adaptive BEM for crack



symmetry case unsymmetry case

1. Problem statement:
$G.E.$: $\nabla^2\Psi(x,y) = -2, \quad (x,y) \in D$
BC: $\Psi(x,y) = 0, \quad (x,y)$ on the boundary

2. By changing of variables, the problem becomes
$G.E.$: $\nabla^2\Psi^*(x,y) = 0, \quad (x,y) \in D$
BC: $\Psi^*(x,y) = (x^2+y^2)/2, \quad (x,y)$ on the boundary
where $\Psi = \Psi^* - (x^2+y^2)/2$

3. Solve Ψ^* and the stress function Ψ by dual BEM.

4. Determine the torsion by

$$M_z = \iint_A (x\tau_{yz} - y\tau_{zx})dxdy$$

where $\tau_{yz} = -\alpha G\frac{\partial\Psi}{\partial x}$, $\tau_{zx} = \alpha G\frac{\partial\Psi}{\partial y}$
G: shear modulus, α : the twist angle per unit length.

5. Compare the results with the following analytical solution Ψ and T:

$$\Psi(r,\phi) = 32\frac{a^2}{\pi}\sum_{n=0}^{\infty}\frac{(\frac{r}{a})^{(2n+1)/2} - (\frac{r}{a})^2}{(2n+1)[16-(2n+1)^2]}sin\frac{(2n+1)\phi}{2}, \quad T = 0.878Ga^4\theta$$

The torsional rigidity C $(= G\pi a^4/2$ for circle) is

$$C = Ga^4\{\frac{512}{\pi}\sum_{n=0}^{\infty}\frac{1}{(2n+1)^2(2n+5)[16-(2n+1)^2]} - \frac{\pi}{2}\} = 0.878Ga^4$$

6. Use equilibrium condition as an error estimator for adaptive mesh generation by

$$U_L^{-1}T_M \ \ or \ \ L_U^{-1}M_T$$

7. Show the results of uniform and adaptive BEM meshes, stress distribution and deformed shape.

References

[1] J. T. Chen, K. H. Chen and C. T. Chen, 2002, Adaptive boundary element method of time-harmonic exterior acoustics problems in two-dimension, Computer Methods in Applied Mechanics and Engineering, Vol.191, pp.3331-3345, 2002. (SCI and EI)

[2] J. T. Chen, K. H. Chen, W. Yeih and N. C. Shieh, 1998, Dual Boundary Element Analysis for Cracked Bars under Torsion, Engineering Computations, Vol.15, No.6, pp.732-749. (SCI and EI)

[3] M. T. Liang, J. T. Chen and S. S. Yang, 1999, Error Estimation for Boundary Element Method, Engineering Analysis with Boundary Elements, Vol.23, No.3, pp.257-265. (SCI and EI)