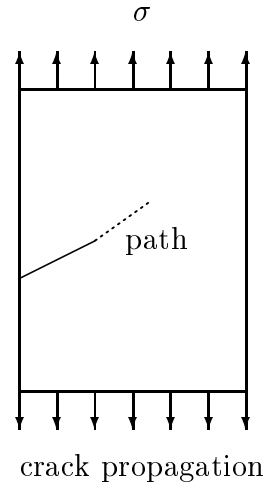
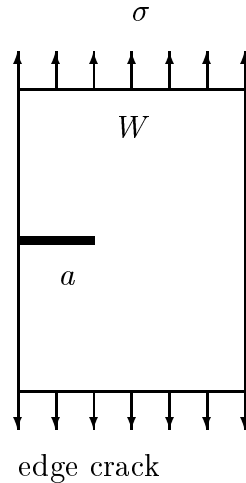


## 邊界元素法1998 第十四次作業



1. Find the stress intensity factor ( $K_I$ ) for the edge crack problem by dual BEM.

Analytical formula :

$$K_I = \sigma Y(a) \sqrt{\pi a}, \text{ where } Y(a) = 1.12 - 0.231\left(\frac{a}{W}\right) + 10.56\left(\frac{a}{W}\right)^2 - 21.74\left(\frac{a}{W}\right)^3 + 30.42\left(\frac{a}{W}\right)^4$$

2. Predict the path of crack propagation under fatigue loading.

3. Please show

- (1) BEM mesh and constraints (boundary condition)
- (2) Deformed plot for some interior points
- (3) Max and min principal stress plot on undeformed geometry
- (4) Max and min principal stress plot on deformed geometry
- (5) The path of crack propagation

$$\frac{da}{dN} = C(\Delta K)^m, \text{ where } C = 4.624 \times 10^{-12}, m = 3.3, R = 2/3$$

3. Fill in the following Table for  $W = 1, a = 0.1, \sigma = 10, E = 200000, \nu = 0.25$ :

|       | Analytical solution | MSC/NASTRAN | Dual BEM |
|-------|---------------------|-------------|----------|
| $K_I$ | 6.635               | 6.255       |          |

## References

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- [2] 陳正宗、林信立、邱垂鈺、黃志勇、全湘偉、韓文仁與秦無忒，1996，有限元素分析與工程實例—MSC/NASTRAN 軟體應用，700 面，北門圖書，台北。
- [3] A. Portela, Dual Boundary Element Analysis of Crack Growth, Computational Mechanics Publ., Southampton, 1993.
- [4] A. Portela, Crack Growth Analysis Using Boundary elements, Computational Mechanics Publ., Southampton, 1995.