Engineering Fracture Mechanics, 1974, Vol. 6, p. 209. Pergamon Press. Printed in Great Britain

LETTER TO THE EDITORS

CONTRIBUTION ON "STABILITY OF CRACKING" BY C. GURNEY and Y. W. MAI†

WE WOULD like to compliment Professor Gurney and Dr. Mai on their paper. The generalized theory of cracking that they present is related to "fracture mechanics" in the same way that Castigliano strain energy theorems for elastic displacements relate to elasticity calculations based upon integration of strain expressions. In equation (1.3)

$$u = \left(\frac{\partial \Omega}{\partial X}\right)_A$$

which is a statement of Castigliano's theorem.

In many ways this line of attack to the mathematics of cracking is more appealing from a teaching viewpoint than a fracture mechanics approach, particularly if the students are not mathematics specialists. The typical X, u, A plots that can be generated lead directly to the quantities actually observed and measured on testing machines, and it is clear that situations can be handled that are too complex for "stress intensity factor" calculations.

The criteria for stability given in section 2 of the paper are elegantly succinct, and again can be sensibly interpreted in terms of the (X, u) response of testing machines. For example, if R loci are generated for the Griffith case from Inglis' mathematics, it is found that as A increases, u decreases according to the quasi-static cracking analysis, i.e. the loci point back towards the origin for small A as in Fig. 5 for the cracked ring case. Physically this means that there is *so much* strain energy present at the initiation of cracking, that energy could be taken *out* of the system and still leave enough to feed the crack. The cracked ring analysis is relevant to stress–corrosion testpieces.

Most people with whom we have talked in the U.S.A. are not familiar with Gurney's work, and Clausing's 1969 paper[1] on crack stability is a commonly referenced publication. We would like to point out that Clausing's criteria for stability are essentially identical with Gurney and Hunt's 1967 criteria (ref. [4] in "Stability of Cracking") for linearly elastic systems. The manipulation required to show this is rather tedious and is not reproduced here. We feel that the method of plotting stability parameters in Clausing's paper has less physical appeal than Gurney's approach.

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REFERENCE

[1] D. P. Clausing Crack Stability in Linear Elastic Fracture Mechanics, *Int. J. Fracture Mech.* **5**, 211 (1969).

†Published in *Engng Fracture Mech.*, Vol. **4**, 853–863 (1972).