



LUND UNIVERSITY

Fracture Mechanics Fundamentals

Talk given at ABB Atom Västerås, Sweden, Orationem Meam

Ståhle, P.

1989

Document Version:

Publisher's PDF, also known as Version of record

[Link to publication](#)

Citation for published version (APA):

Ståhle, P. (1989). Fracture Mechanics Fundamentals: Talk given at ABB Atom Västerås, Sweden, Orationem Meam.

Total number of authors:

1

General rights

Unless other specific re-use rights are stated the following general rights apply:

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

Read more about Creative commons licenses: <https://creativecommons.org/licenses/>

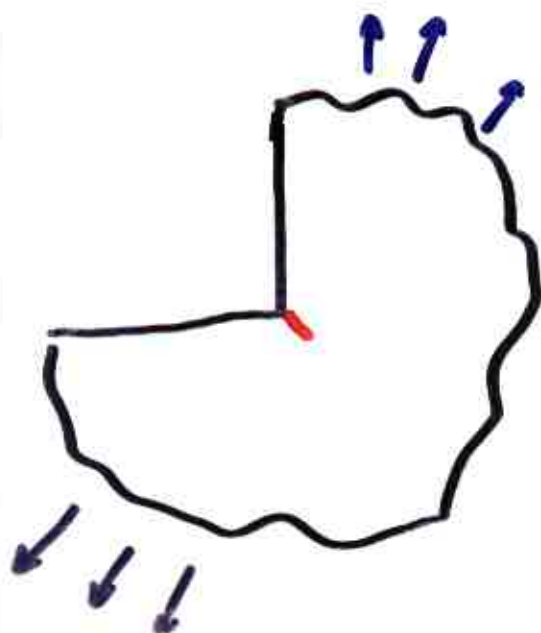
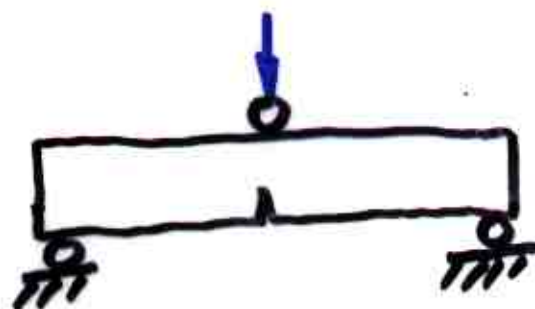
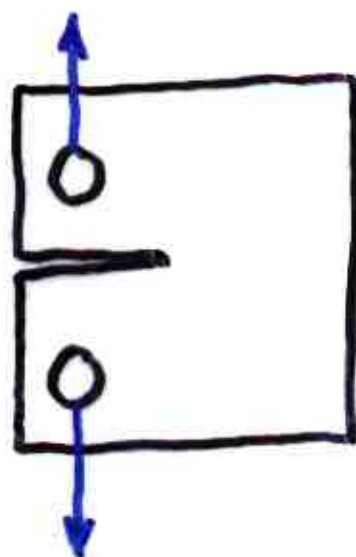
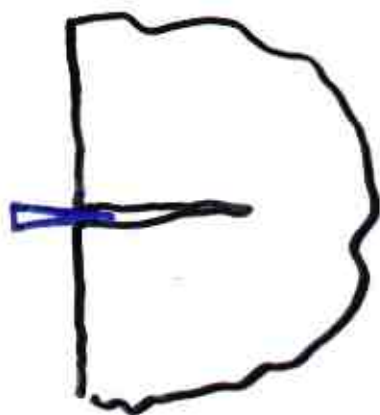
Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

LUND UNIVERSITY

PO Box 117
221 00 Lund
+46 46-222 00 00

Olika belastningsklasser



Klassemha Teller Q.

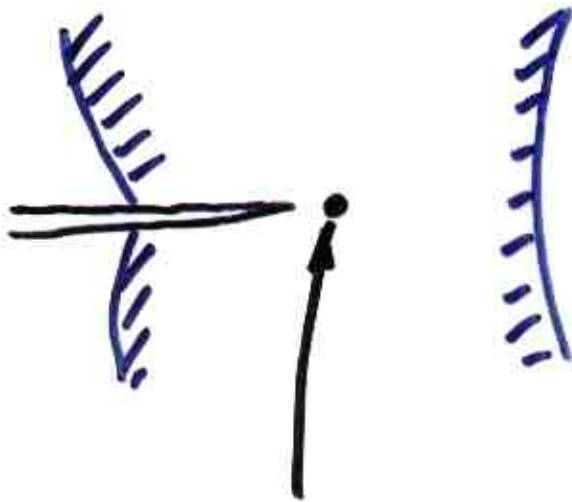
T-stress

Rice 1976

Larsson & Carlsson 1978



$$\sigma_{ij} = \frac{K_I}{\sqrt{2\pi r}} f_{ij}(\theta) + T \cdot g_{ij}(\theta)$$



$$Q = \frac{(\sigma_{\theta}(\theta=0))_{\text{actual}} - (\sigma_{\theta}(\theta=0))_{\text{prandtl}}}{\sigma_s}$$

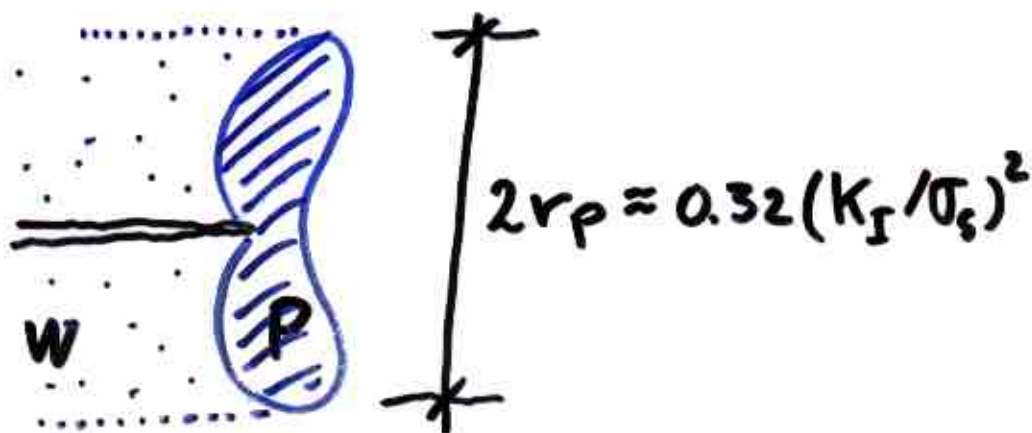
Fong & O'Dowd 1991

$$\frac{\sigma_{ij}}{\sigma_s} = \frac{f_{ij}(\theta)}{\sqrt{2\pi(r\sigma_s^2/K_I^2)}} = \frac{f_{ij}(\theta)}{\sqrt{2\pi r}}$$

- Alla längder jämförs med längden

$$(K_{Ic}/\sigma_s)^2$$

Ex. Plastiska zonen storlek r_p ,



$$a_{ASTM} = 2.5 (K_{IC} / \sigma_s)^2 \epsilon$$

$$\approx \frac{2.5}{0.16} r_p \approx 16 r_p$$

Väl; följande kriterier
för linjär brottmekanik:

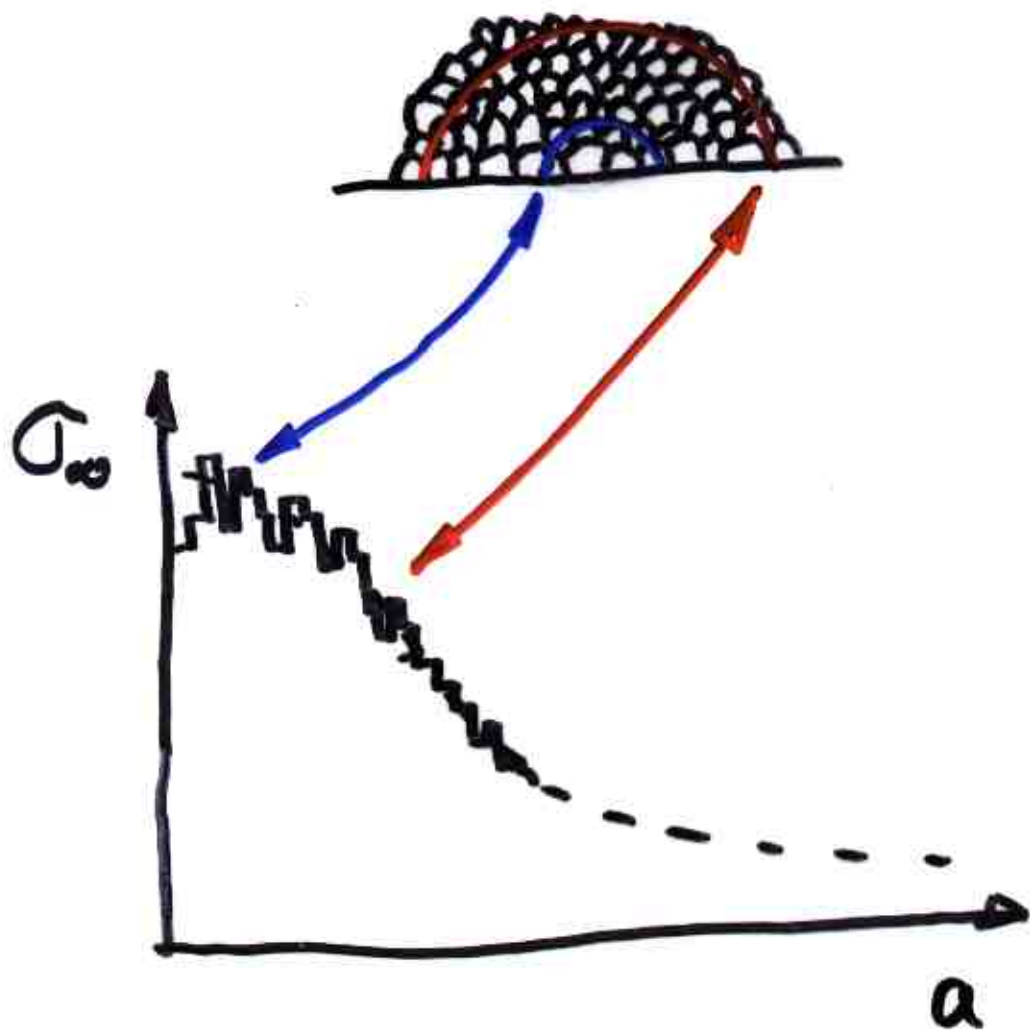
$$a > a_{ASTM}$$

och

$$a > 16 l_{gr}$$

l_{gr} = kornstorlek

Spridning pga växelverkan mellan korn och spricklängd



- multiple cracking

Ex plastiskt

$$COD_{tip} = \frac{K_I^2}{\sigma_s E} = \frac{\pi a \sigma_\infty^2}{\sigma_s E}$$

$$\sigma_\infty = 0.3 \sigma_s, E = 1000 \sigma_s$$

$$l_{gr} = 50 \mu m, a = 16 l_{gr}$$

$$COD_{tip} = 0.23 \mu m$$

Ex. Elastiskt

$$\left. \begin{aligned} COD &= 4\sqrt{\frac{2}{\pi}} \frac{K_I}{E} \sqrt{r} \\ K_I &= \sigma_{\infty} \sqrt{\pi a} \end{aligned} \right\} \Rightarrow COD = 4\sqrt{2} \frac{\sigma_{\infty}}{E} \sqrt{r \cdot a}$$

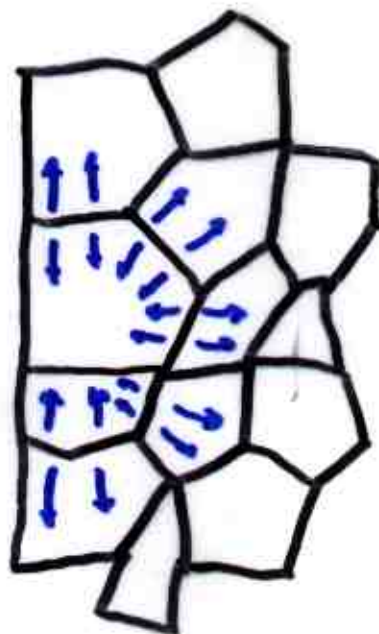
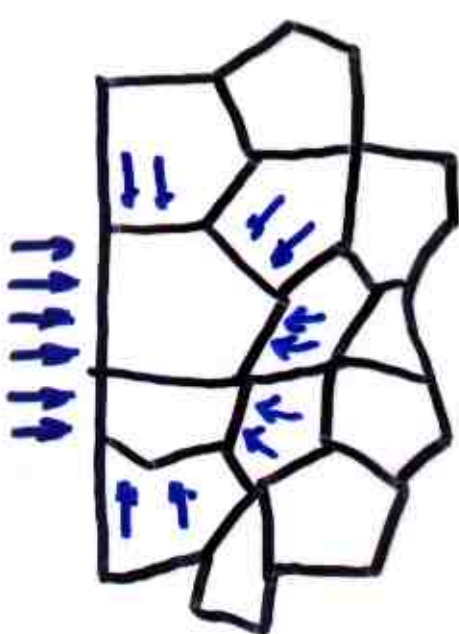
$$COD_a = 4\sqrt{2} \frac{\sigma_{\infty}}{E} a$$

$$\sigma_{\infty} = 0.3 \sigma_s, \quad E = 10000 \sigma_s$$

$$l_{gr} = 50 \mu m, \quad a = 16 l_{gr} = 0.8 \mu m$$

$$COD_a = 1.4 \mu m$$

$$COD_{l_{gr}} = 0.4 \mu m$$



Plastisk deformation av ett korn.

Energi:

$$W_{gr} = 3\sigma_s \varepsilon l_{gr}^3 = 7.5 \cdot 10^{-7} \text{ Nm}$$

Jfr.

$$m = 0.1, S = 1 \text{ cm}$$

$$W = gms = 0.01 \text{ Nm} = 13000 W_{gr}$$

$$\text{dvs. } 24 \times 24 \times 24 l_{gr}^3 = [1.2 \text{ mm}]^3$$