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## On the Mechanics of a Thin Metal and Polymer Foil Laminate

Seminar at Tetra Pak, Modena, Orationem Meam.

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2019

*Document Version:*  
Förlagets slutgiltiga version

[Link to publication](#)

*Citation for published version (APA):*

P., S. (2019). On the Mechanics of a Thin Metal and Polymer Foil Laminate: Seminar at Tetra Pak, Modena, Orationem Meam.

*Total number of authors:*

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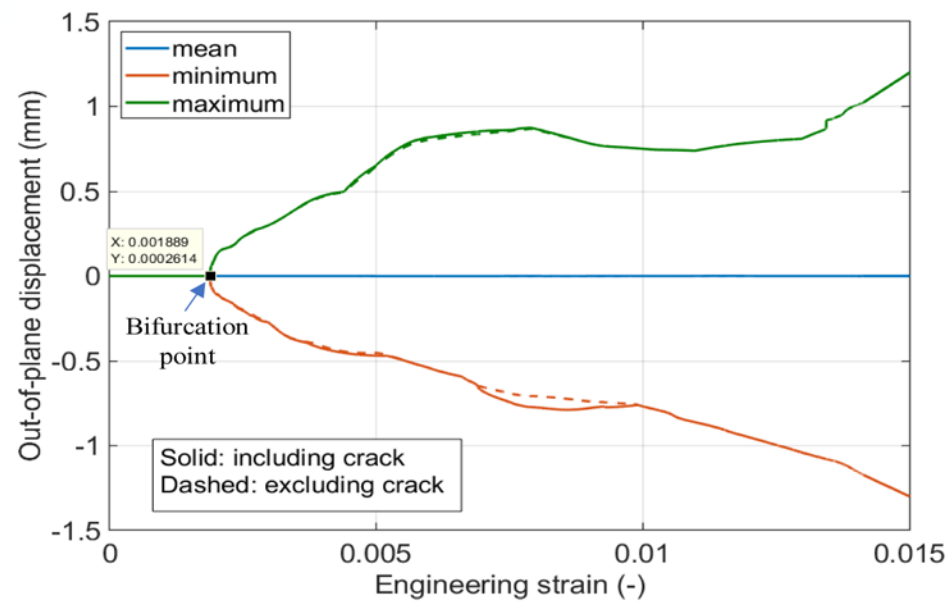
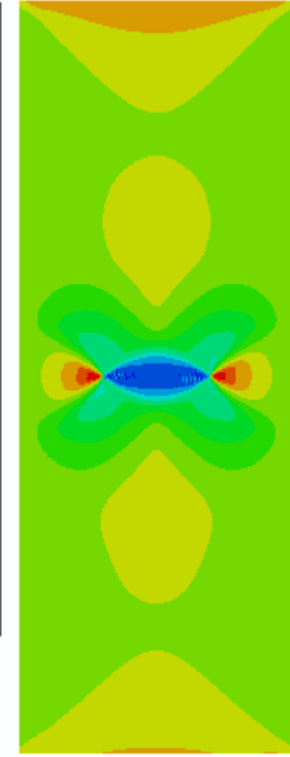
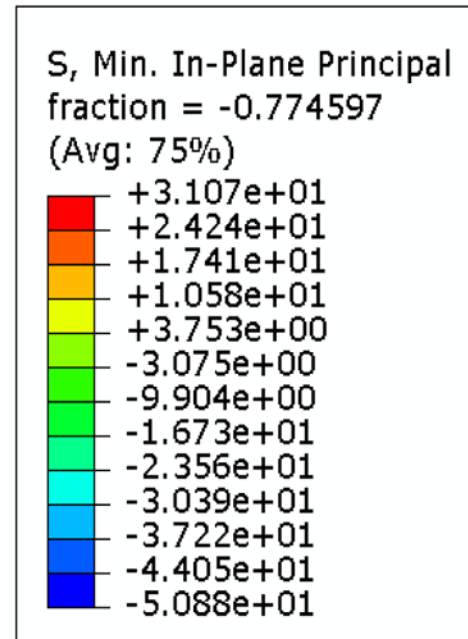
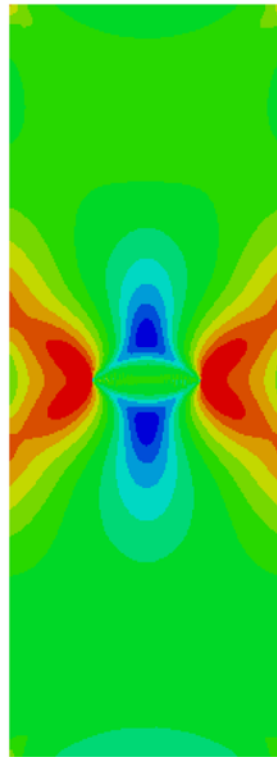
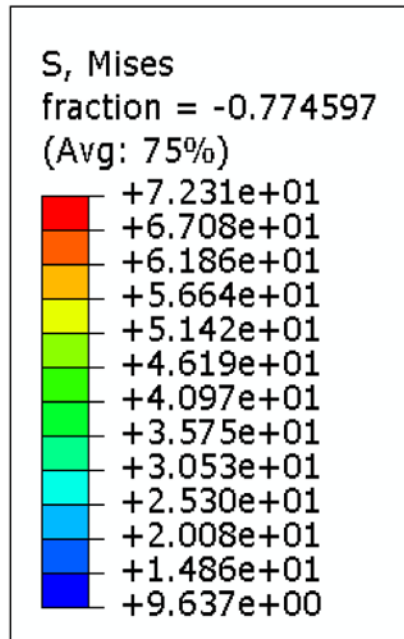


# Tetra Pak, Modena

January 25th 2019

1. buckling and reduction of energy release rate  
Politech Milano, BTH, LU
2. Cutting and non-linear fracture mechanics  
Parma University, LU, BTH

# Mises stress and Min. principle stress at bifurcation point:



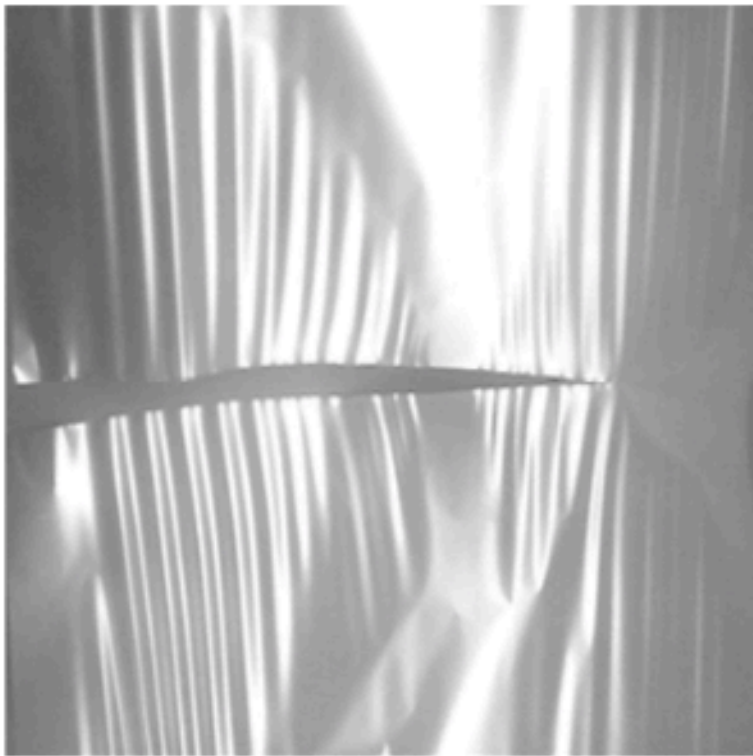


FIGURE 3. Buckling pattern

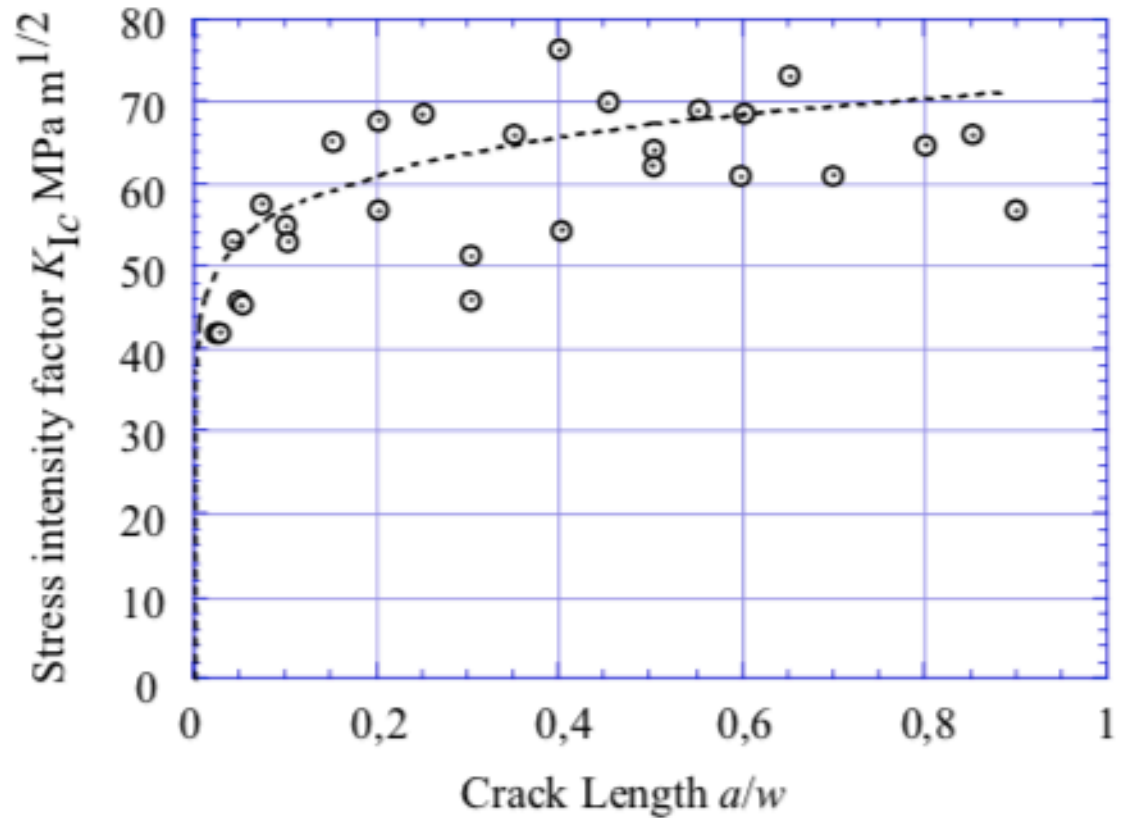
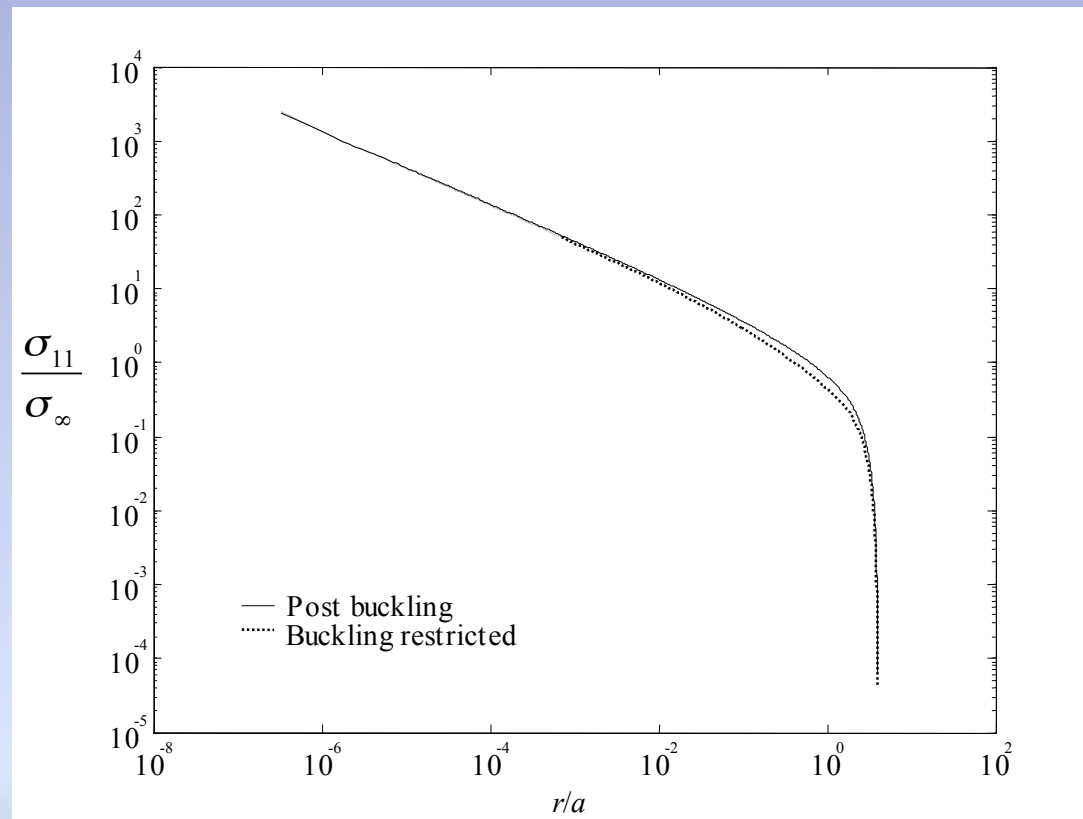
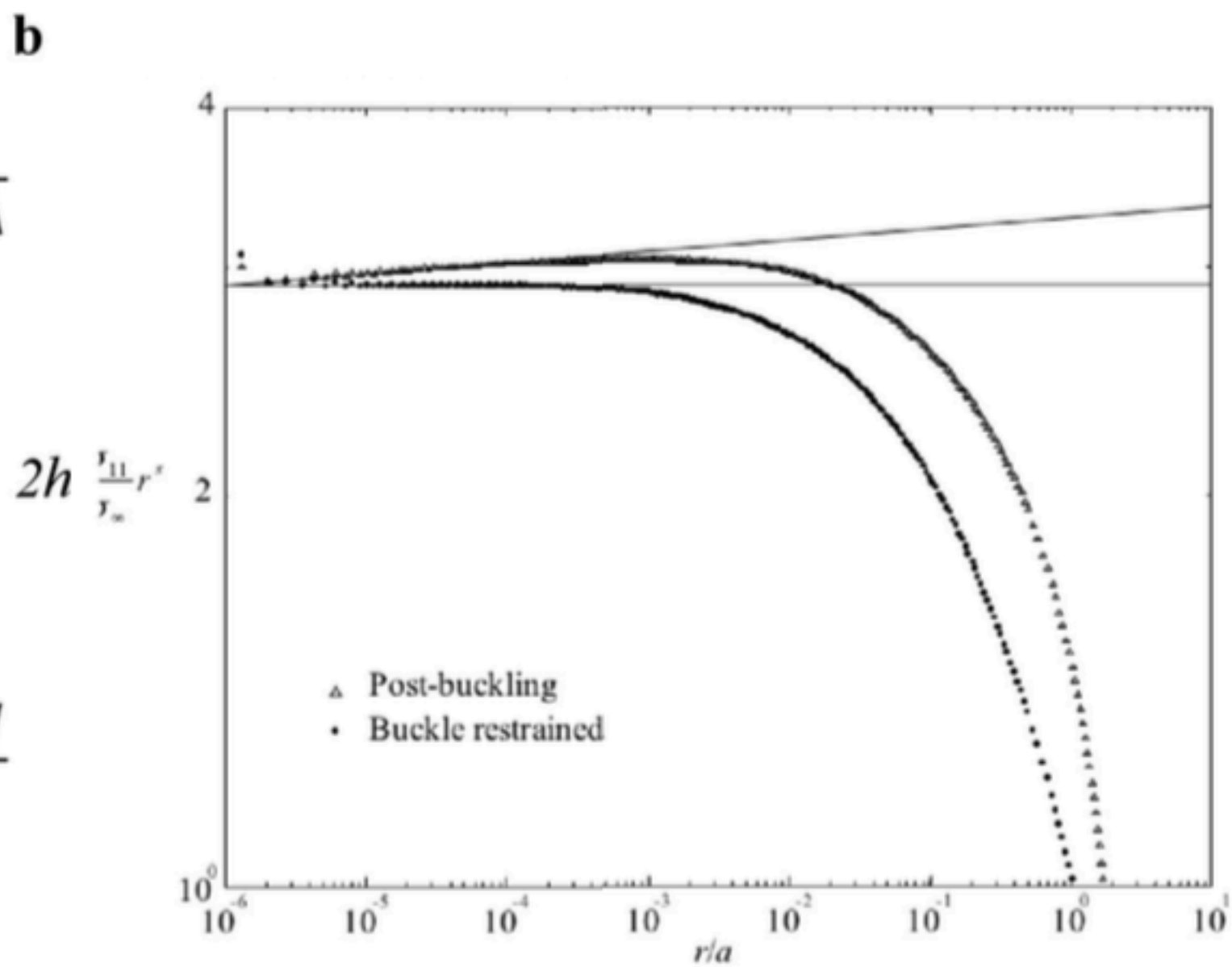
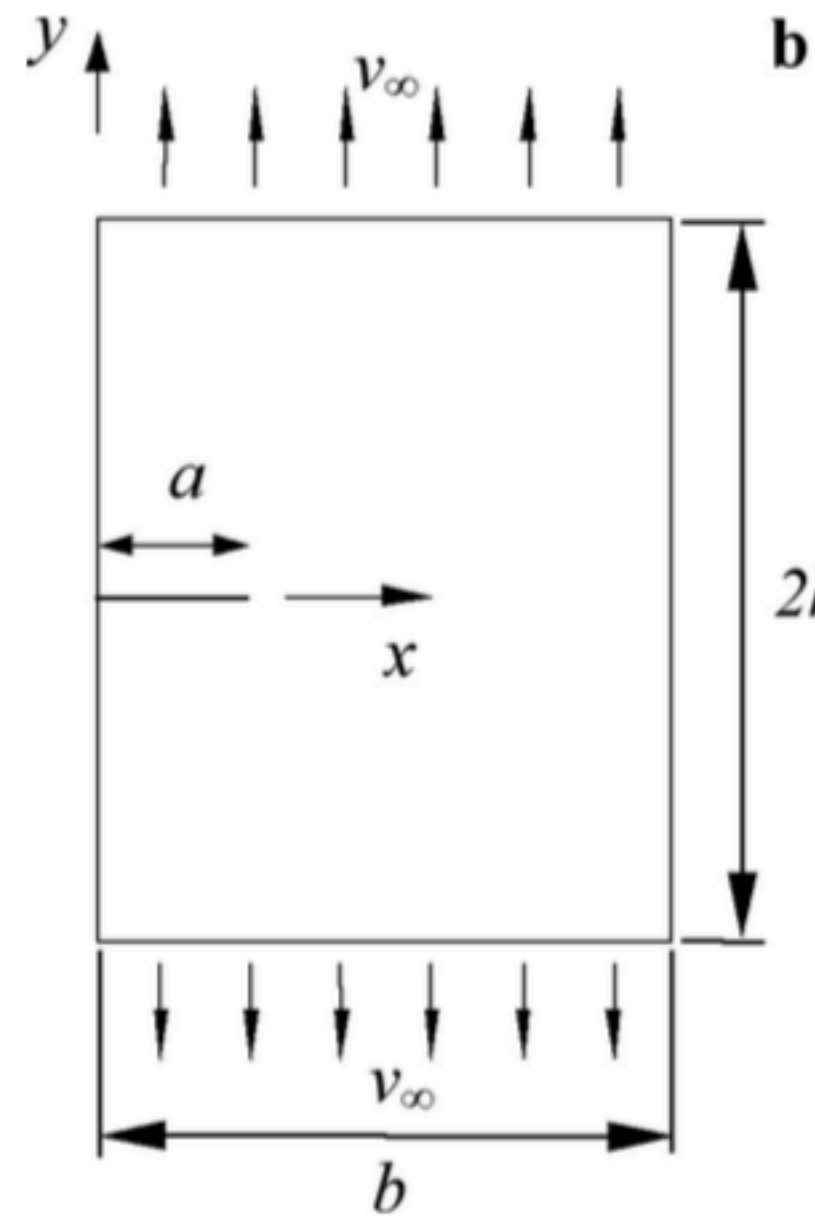


FIGURE 4.  $K_{Ic}$  results for the different tests. Dashed curve shows the theoretical result for  $s = 0.4$ .

- Central crack Denser case,  $a/b = 0.1$



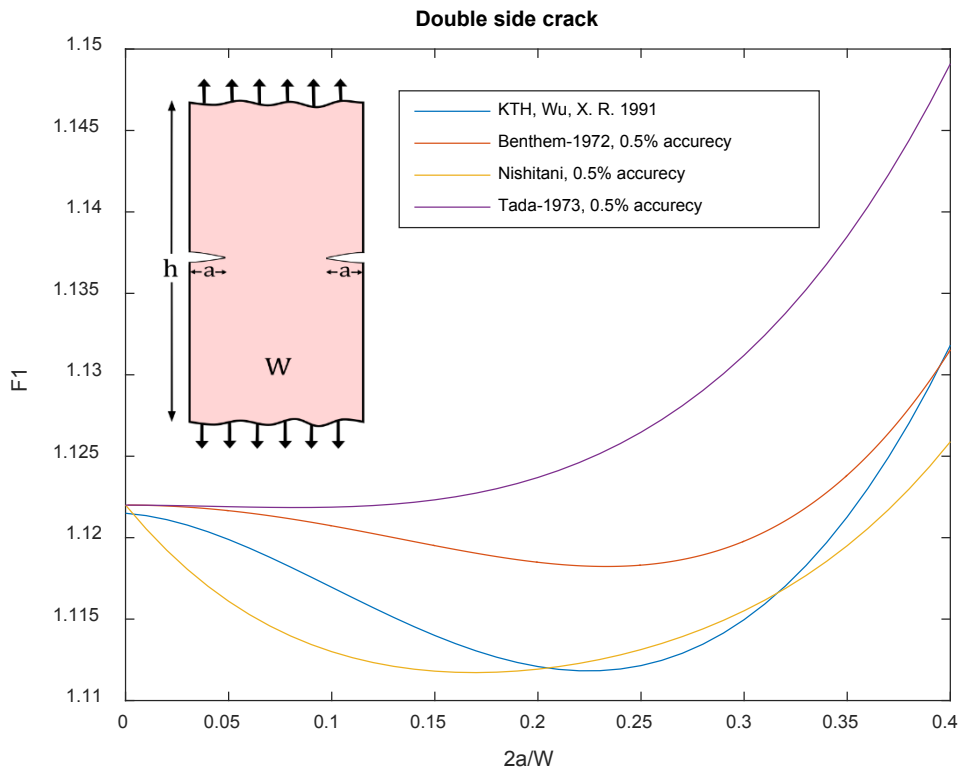
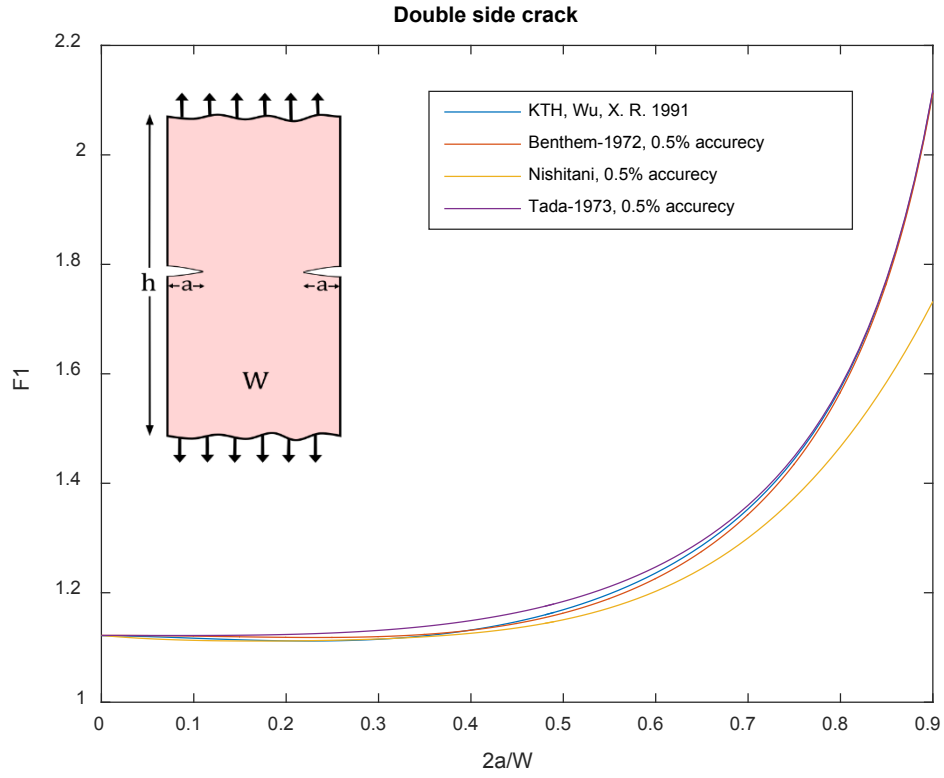


## Influences on fracture criteria prediction

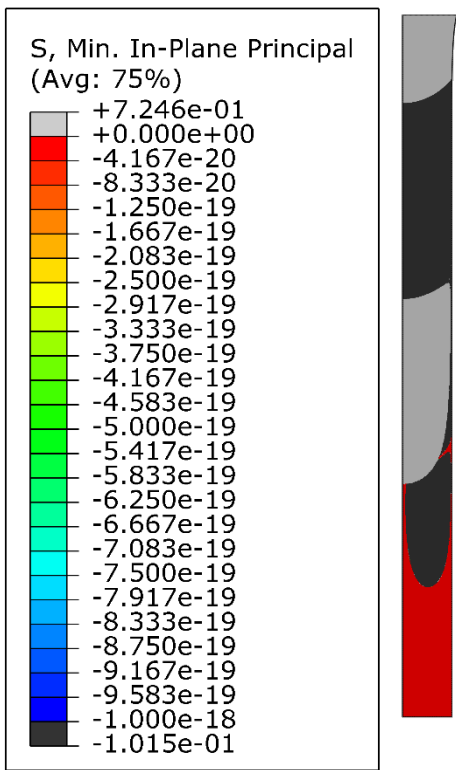
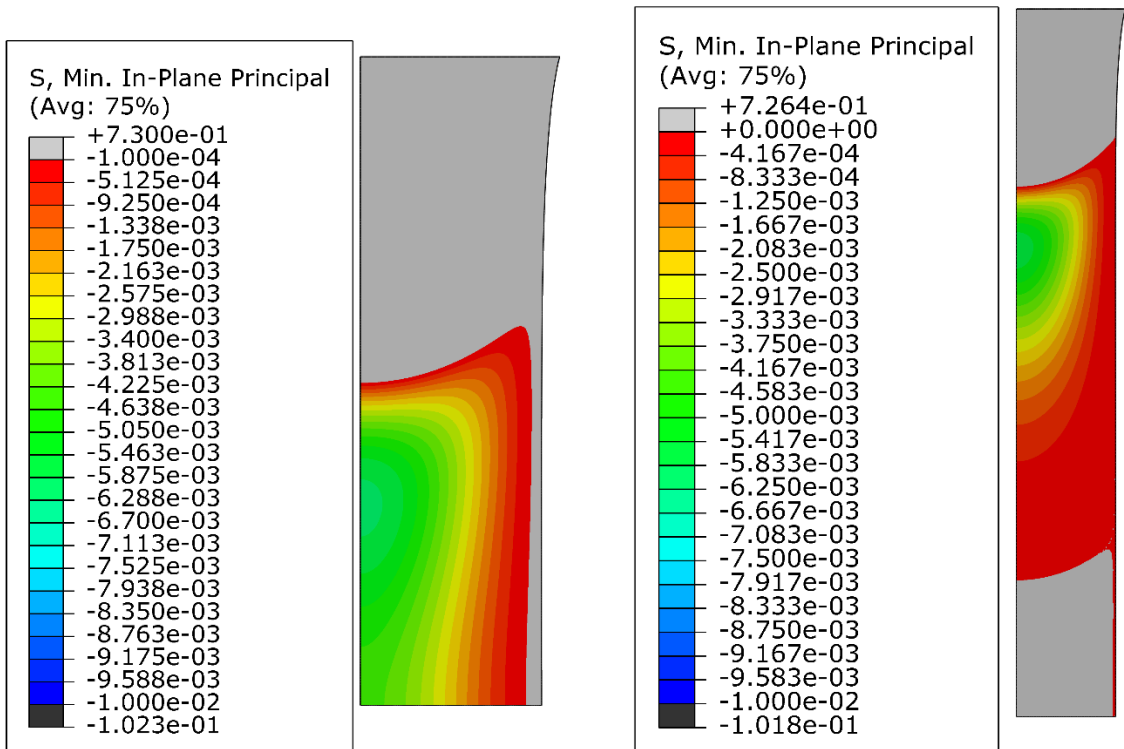
- The load capacity can be determined as:

$$\sigma_c = \frac{k_c \sigma_o (2\pi a / r_o)^s}{f(a/b, h/b)}$$

- The micro structural distance :  $r_o = K_{Ic}^2 / \sigma_o^2$
- At a critical load the load parameter  $k = k_c = K_I / K_{Ic}$



Formula and accuracy source: KTH [1,2,3], Benthem [4], Koiter [4], Tada [4], Murakami [5] and Nishitani and others [See Mahdih's reference]

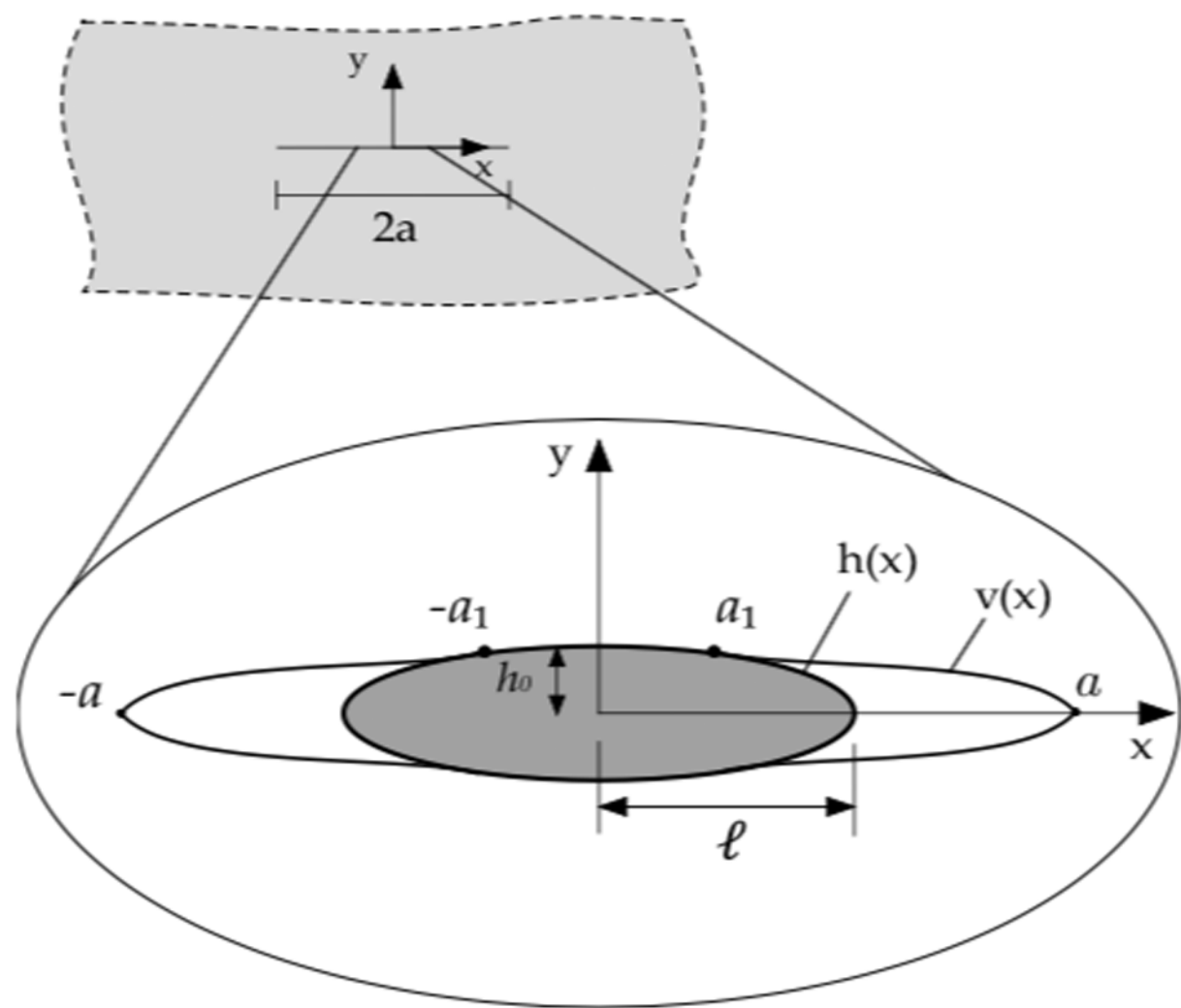


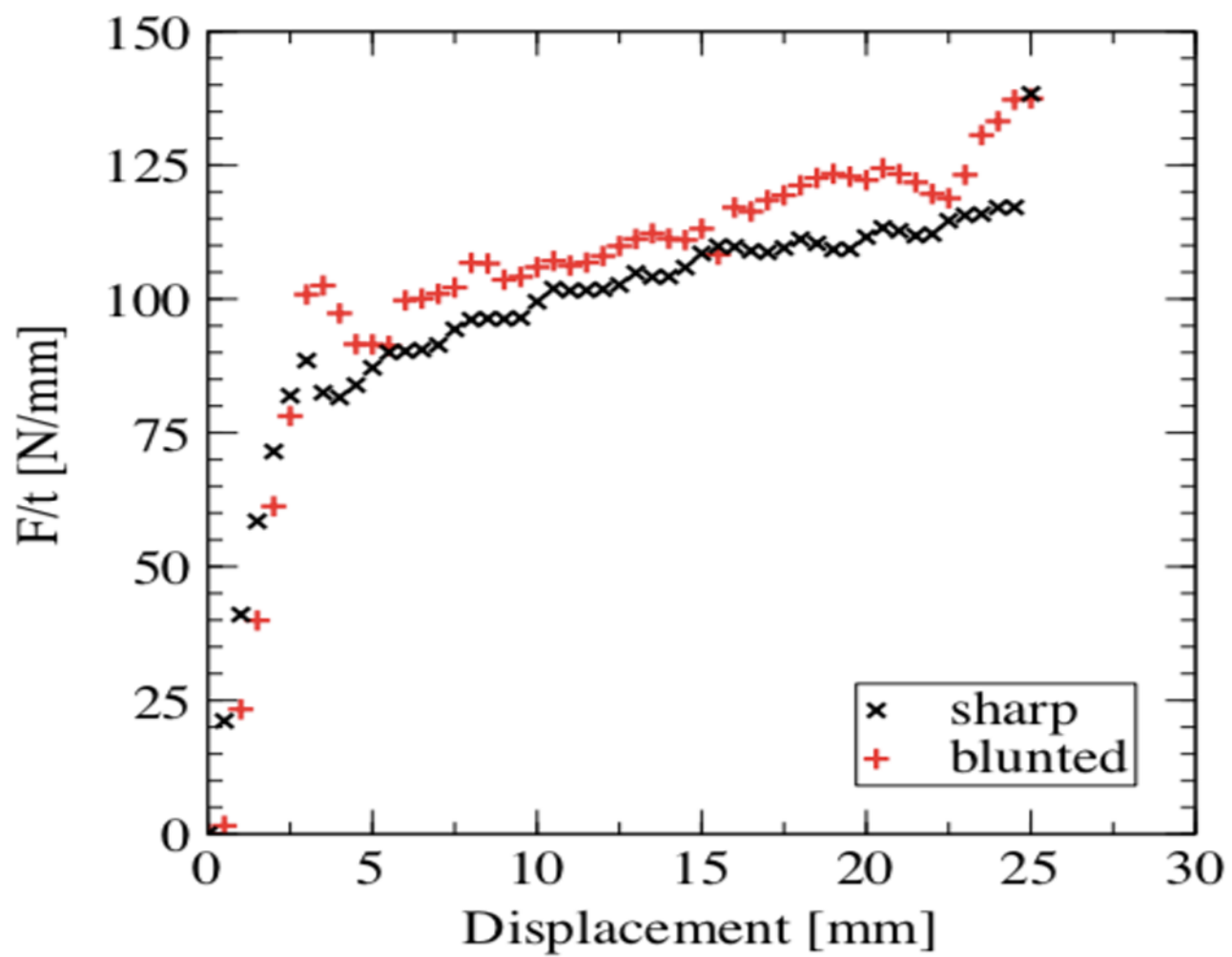
Same condition as earlier studies (Except deformation is not exactly scaled).  
 $L$ =length,  $W$ =width,  $r = \frac{L}{W}$ .  
 For  $r=2.5$  compressive stress order  $1e-3$ . For  $r=5$  no compressive stress. For  $r=10$  compressive stress is back and is in the order  $1e-19$ .  
 Conclusion: Probable 'r' value to neglect clamp effect at the centre region,  $2.5 < r < 5$

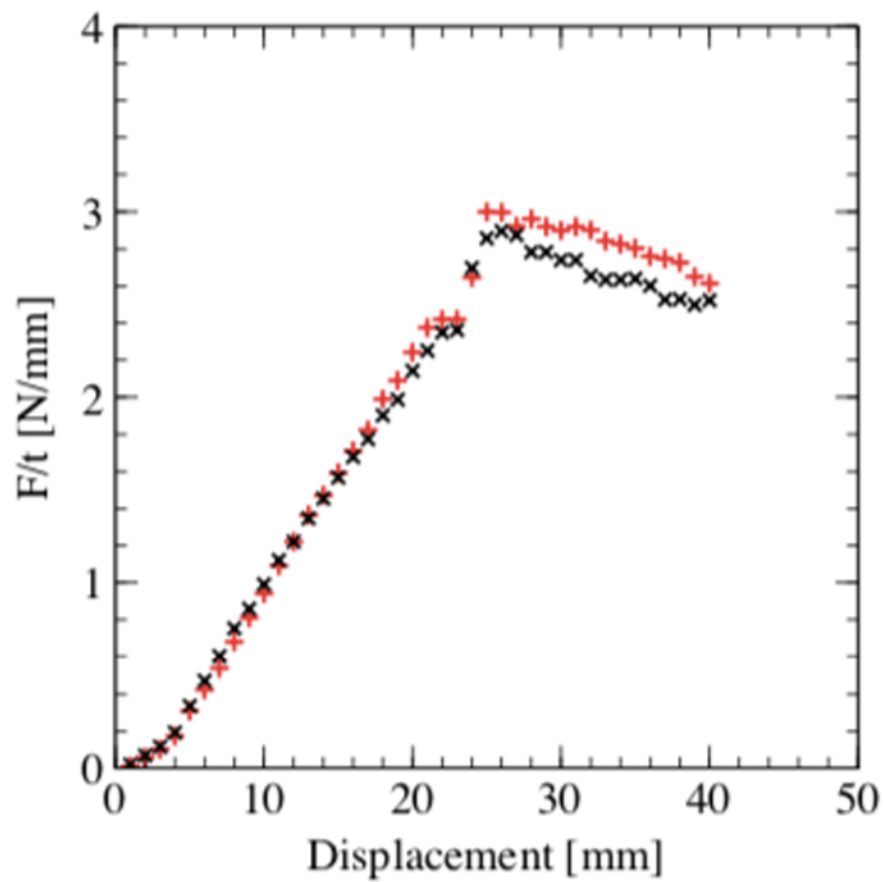
# Tetra Pak, Modena

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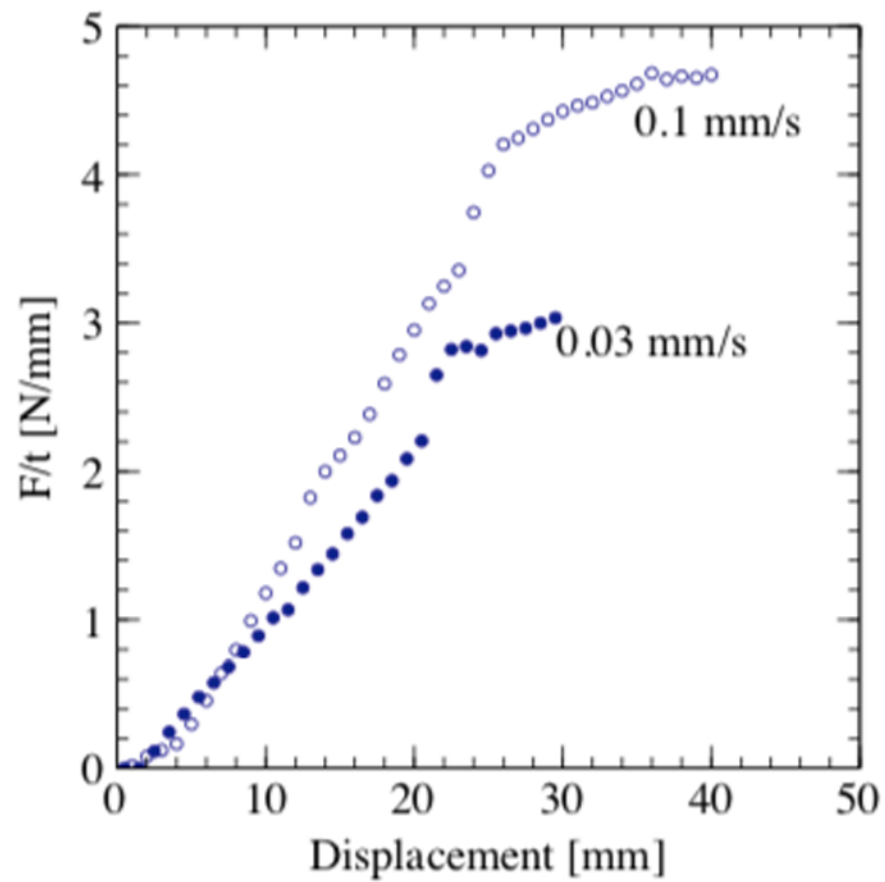
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(a)



(b)