T72S01 Homework for Session 10 (Upper Bound Theorem)

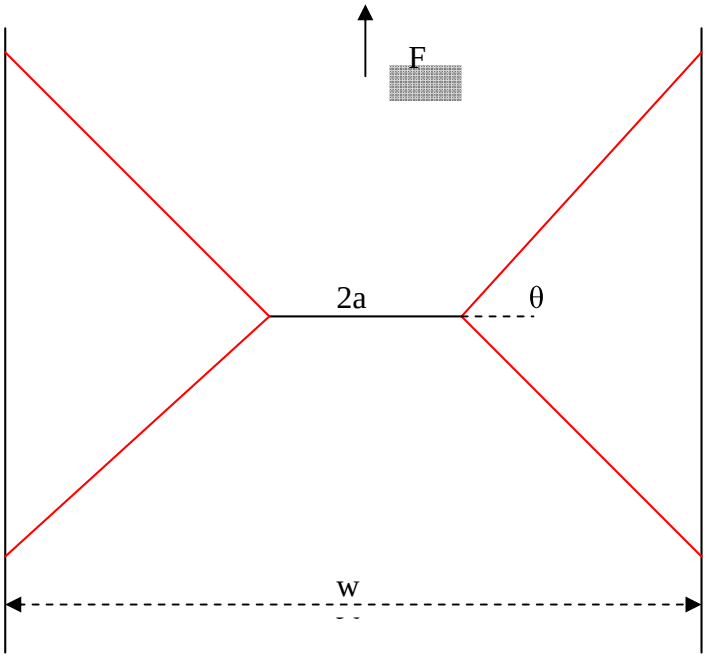
Mentor Guide Knowledge & Skills Questions

1.17 Define what is meant by "reference stress".

1.18 Derive the reference stress for a simple example case, e.g. a beam or pipe in bending.

Algebraic Question

A plate of thickness t contains a fully penetrating crack of length 2a at its centre. It is subject to a tensile load, F. A collapse mechanism is postulated in which slip lines run at angles θ from the crack plane, as shown below in red.



- Find the upper bound to the collapse load which corresponds to this mechanism in terms of the shear yield stress, τ_y .
- Find the optimal collapse load from this mechanism (i.e., find the angle which gives the minimum upper bound).
- What are the resulting collapse load estimates for, (a)the Tresca, and, (b) the Mises criteria, in terms of the uniaxial tensile yield stress, σ_y ?
- How do these collapse estimates compare with the obvious lower bound solution? Hence conclude the exact Tresca solution.