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**Fracture Mechanics Assignment 3A picture containing text, screenshot, diagram, font

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The stress field in the global reference frame is:



The first and second points on the Mohr circle are:  and 

* The two points are  and 

The Mohr’s circle for this stress field is:

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where the centre c and radius r of the circle are:  and 

The stresses  and  in the local reference frame are given by:

(answer)  
 (answer)

Finally, the stress intensity factors are given by:



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The energy release rate G is the sum of each mode:



A fracture criterion is obtained by setting *G* equal to the material’s toughness:

(1). The plate is also conditioned as thin

* plane stress condition is assumed so

Additionally, we have: . In this exercise, 

* 

Plug in equation (1), we have: 

*  (answer)

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To find the angle of crack propagation, we set , and this gives:



* 

We are also given the information that 

* 

We can apply these two identities to simplify the equation

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* 

Let . Replace this into the equation: 

We can further factorize the equation as:

. # Numerical solution applies here

* 
* 
* 
* 
* 
* 
* 
* 

We can either have  => 

or

Numerical solution in MATLAB

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From the numerical solutions

 radian

 radian

The correct angle  is the one corresponding to the maximum . Plotting



We are also given the information that , so we need to maximize this quantity



Plugging the solutions above:

=> 

=> 

=> 

Therefore, it shows that  corresponds to a maximum in , whereas  corresponds to a minimum in . Therefore, the crack will propagate along (answer)