**Name: Nguyen Xuan Binh**

**Student ID: 887799**

**Fracture Mechanics Assignment 2**

A picture containing text, screenshot, diagram, line

Description automatically generated

A picture containing text, screenshot, diagram, line

Description automatically generated

A picture containing text, screenshot, diagram, line

Description automatically generated

From the figure, each arm is displace by from the horizontal middle plane. On the cross section, we can see that the height of upper arm is 1h and lower arm is 2h. The width of the chopstick is B = h. There is no applied force in this case, but instead with a wedge, so this is a displacement control setting. Assume the wedge applies the reaction force P on the chopsticks, from the beam theory of cantilever maximum displacement, we have:



For the upper arm of the chopstick, we have:

* Inertia: 
* Compliance:  (answer)

For the lower arm of the chopstick, we have:

* Inertia: 
* Compliance:  (answer)

A picture containing text, screenshot, diagram, line

Description automatically generated

The compliance of the whole system is



Then we derive the force P as the function of displacement



The energy release rate in the load control setting is

 (answer)

A picture containing text, screenshot, diagram, line

Description automatically generated

Under displacement control, the energy release rate is:



Assuming that the material has a flat R-curve, crack growth is stable under displacement control.

A picture containing text, screenshot, font, algebra

Description automatically generated

A picture containing text, screenshot, font, algebra

Description automatically generated

The plate is thin and large => The plane stress condition is assumed

* 

The moment at which fracture will become unstable is when:

 and 

The first condition gives us:

 (I)

Whereas the second condition returns:

 =>  (II)

Combining two equations, we have the following equality:



We have only one unknown variable here, which is a. According to the exercise, a maximum stable crack growth is 6.3mm at both tips, which means . Replace all identities to the equation, we have:



* 
* 

Both sides are equal => a maximum stable crack growth is 6.3mm at both tips

A picture containing text, screenshot, font, algebra

Description automatically generated

We can substitute the stable crack growth into the second equation to obtain the critical stress



*  (answer)

A screenshot of a test results

Description automatically generated with low confidence

Unit of energy release rate is  or . If the compliance C is a linear function of the crack length a, then, dC/da will be a constant and the energy release rate G will be independent of the crack length a.

We can calculate the critical energy release rate  at each stage

1st record: 

2nd record: 

3rd record: 

4th record 

5th record 

On average, the critical energy release rate is = . The difference between each record may be due to erroneous measurements. This conclusion can be wrong, as true answer of is . The answer uses second order polynomial fitting to derive the value of 