

# Fracture Mechanics Term Project\_ME524

## Interaction of Inclusion and Crack by Determination of the Stress Intensity Factor

The main objective of this project is to investigate the effect of an inclusion on the stress intensity factor of a crack-tip. This should be done by a commercial software such as ANSYS. In some simple cases, there is an analytical solution for this interaction effect but in general it should be evaluated by numerical method such as finite element. ANSYS program, due to its various types of element and strong capability on crack analysis, is chosen to perform the necessary numerical analyses.

In the following problem, which is illustrated in Figure 1, compute stress intensity factors at all crack tips denoted as A-F and fill out Table 1. These stress intensity factors are modified by the effect of an inclusion of different elastic material on the stress state around a crack in an infinite plate (with plane stress state) subjected to tensile loading. The cases without inclusion means that the whole domain has the material properties of the matrix. The Elastic Modulus of the matrix,  $E_{\phi}$ , is equal to  $10e3$  MPa. Use consistent units of N & mm, respectively for Force and Length, resulting in MPa for stress unit.

Tasks:

1. Compute J-integral for crack tip C.
2. Include figures of the partitioned area, mesh and the deformed shape around the crack region for distinct material case (E ratio of 10) with your final report.
3. Fill out table 1.

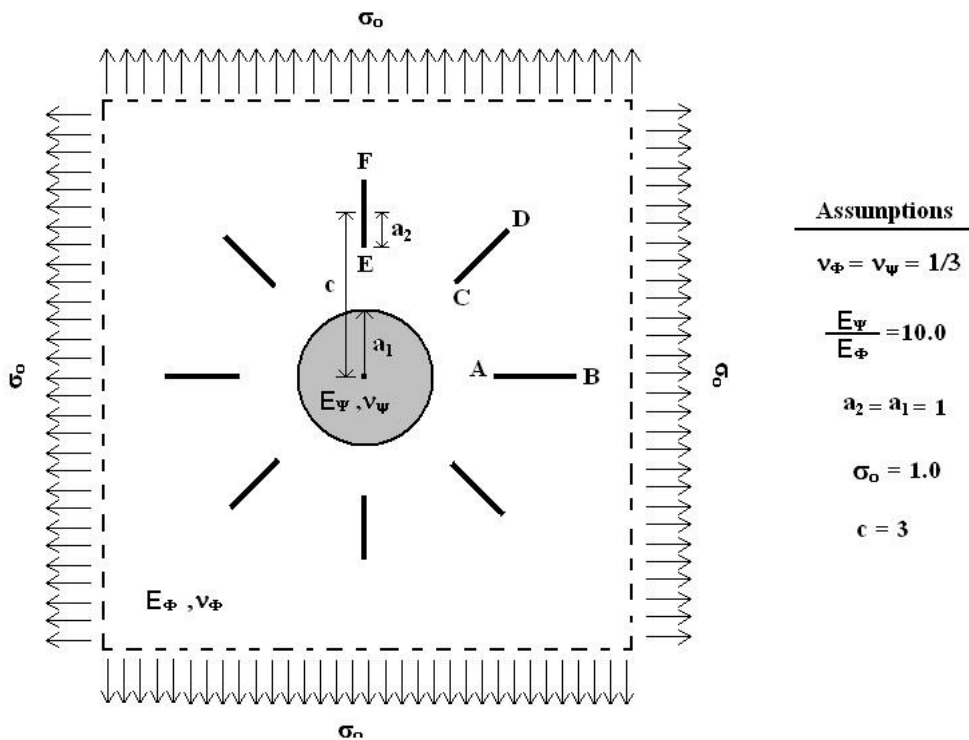


Figure 1) Configuration of the problem

Table 1) SIFs in different cases for all crack tips

Crack-tip	The case without inclusion		The case with inclusion	
	KI	KII	KI	KII
A				
B				
C				
D				
E				
F				