# CHAPTER 5

# CONCLUSION AND RECOMMENDATION

## 5.1 Conclusion

As conclusion of this project, the author had achieved the objectives to plot two types of graph which are:

a) Graph of stress intensity factor versus $\frac{W}{B}$ ratio for $0.45 \leq \frac{a}{W} \leq 0.55$ are show by figures 4.1 and 4.2
b) Graph of stress intensity factor versus $\frac{a}{W}$ ratio for $2.0 \leq \frac{W}{B} \leq 4.0$ are show by figures 4.3, 4.4, 4.5 and 4.6

Empirical calculation and numerical method had showed good agreements with average percentage difference are 8.67% and 8.58%. So, both of them have the same efficiency. The rational of this percentage difference in the case of numerical method, is because of the course of meshing. The fine the meshing the accurate stress intensity factor will generate. Besides that, KCALC command used to extract stress intensity factor at the crack tip is also the factor that can contribute. KCALC command only compatible and consider elasticity effect and neglect if there is small plasticity effect.

These graphs are a new method for designer, engineer or technical personnel to obtain stress intensity factor. They do not have to consume much time. By comparing both of these methods in graphs, experimental techniques can no longer be a choice to user that wants to find stress intensity factor. User also did not have to do simulation again in ANSYS and calculate repeatedly by using empirical equation. User only has to interpret from graphs to find stress intensity factor. These graphs are really effective and easy to use.

## 5.2 Recommendation

### 5.2.1 Numerical Method (ANSYS software)

In term of enhancing accuracy of stress intensity factor from ANSYS, further research of application of ANSYS should be done. There are many factors affecting accuracy value of stress intensity factor. In real situation, there are situation where the load or stress applied to the structure come from various direction which is called mix mode condition. To simulate the real situation, if possible the future project should consider this. In addition different finite element method software other than ANSYS should be use to compare the value in order to verify the analysis.

### 5.2.2 Fracture control

In term of real situation, fracture control is the most effective methods to reduce failure of components. Fracture control denotes the concerted activity of designer, maintenance engineers and all other concerned technical personnel to ensure safety and efficient functioning of a structure or a machine.

The first recommendation by the author is inspection. The crucial component of fracture control is the planning of inspection schedules. Inspection inevitable no matter how benign the loading is or how controlled the operating environment. Inspection frequency is very important to reduce risk of failure of component or structure.

The second recommendation is by using fail-safe design. Fail safe designs give warning before final fracture. This kind of design had been use in pipe lines and pipe lines where had been design to leak before breaking. The designer has to select the right material and wall thickness to promote leaking before breaking. Designer should ensure that critical crack depth is greater than wall thickness.

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