1. **INTRODUCTION**

The initiation and propagation of a crack in the structural joints is a significant problem of intense debate. There have been a number of experimental studies which characterise the toughness of adhesive joints, based on the fracture mechanics [1,2]. The most common type of fracture toughness test was a double cantilever beam (DCB) specimen. However, the double torsion (DT) specimen, which was originally applied to study the toughness of polymer solids, has advantages compared with DCB specimen, in that specimen geometry is simple, and loading is in compression avoiding
problems of gripping the specimen. An approximate linear compliance at various crack lengths is conducive to producing stable crack growth at a constant stress intensity factor. However, there has been little effort expended in using the DT specimen to study the fracture toughness of adhesive joints, except for the work of a few investigators [3,4,5].

The fracture mechanics test for adhesive joints lead to more detailed study of the stress distributions in the crack tip region. There have been a few early studies which used a finite element method to analyse the stress distribution near the crack tip in the adhesives of the DCB specimen [6,7]. However, the characteristics of the stress field near the crack tip in the adhesive is generally difficult to obtain even for elastic behaviour to the complexes introduced by the singularity at the crack tip and the discontinuous material properties.

The objective of this study is to analyse the stress distribution and the size of the plastic zone occurring ahead of the crack in the adhesive in the centre-bond plane of the adhesive joints subjected to mode I deformation and to correlate these with the toughness results obtained by using the DT specimen.