

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Mechanical joining using pin or a rivet is one method for joining parts. The pin-joint structure is one of the important members of aerospace vehicles. There are many reasons to be careful in dealing with these structure members, because of the possibility of serious failures such as crack due to stress concentration induced by contact phenomenon. Many researchers have dealt with pin-joint structures. In most cases, the contact condition is the issue of these joint structures, while many other design parameters such as friction, interference-fit, and clearance-fit also affect the structural safety. The interference-fit pin-joint is a member whose diameter of the pin is larger than that of the hole, and the clearance fit is the opposite case. To solve the contact problem of pin-joint structures, various analytic solutions and numerical methods such as the finite element method can be used. The difficulty with this method is that the presence of a hole in a plate subjected to external loading introduces a disturbance in the stress field. Stress concentrations are generated in the nearest area of the hole making the joint a weak one.

The example of material that usually used in pin joined situation on aerospace is composite material. Composite materials are becoming more popular and are used in almost all fields due to their high strength to weight ratio, good fatigue resistance, corrosion resistance etc. compared to metals. They are used for aircraft structures to golf clubs, electronic packaging to medical equipment, and space vehicles to home buildings due to

their good mechanical properties. In the practical use of composite structures certain discontinuities like holes and cutouts arise while joining by rivets or pins.

However, because of composite material that have expensive price and it is hard to make, the aluminum and mild steel plate will be used in this research. Aluminum is a common sheet metal that usually has in composite plate combined with other type of fiber. The common failure modes in mechanical joint will be examined. Failure in mechanical joint can be classified into three types that are bearing, shear out and net-tension or normal. So, types of damage in pin-loaded aluminum plate and mild steel plate will be examined whether it is bearing, shear out, net tension or combination of these.

1.2 PROBLEM STATEMENT

In mechanical joint, we need to find the correct point where the hole of joint such as rivet or pin that is suitable for the part. It is important to avoid from any incident that cause of the joint such as in aerospace technology. The location where the part join need to be at best point where if the failure happened, it will not cause any disaster such as bearing failure. So the ratio E/D and W/D [refer to **Figure 3.2**] is important and needed to find the correct location where the part can be jointed and analyze the failure that occur at the point.

1.3 OBJECTIVES

To investigate the type of mechanical joint failure (net-tension, bearing and shear out) in pin loaded aluminum plate and mild steel plate.

Investigate failure load in an aluminum plate, with a circular hole, which is subjected to a traction force by a pin.

1.4 SCOPES

Vary the edge distance to hole diameter (E/D) and width to diameter (W/D) ratios [refer to **Figure 3.2**].

Using aluminum plate and mild steel plate with same thickness that is 2mm.