CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Composite materials are being used for applications in aircraft and automotive structures to meet stringent weight band manufacturing cost constraints. Composite materials can exhibit crushing modes which are significantly different from the crushing modes of metallic materials. Axial crushing of fiber-reinforced plastic (FRP) composite tubes has indicated that significant energy absorption can be obtained from these materials, under some circumstances exceeding that which can be obtained from metal tubes of similar size, and thus offering the prospect of providing energy absorption with structures of weight less than that of comparable metal structures [1].

The energy-absorption capability is dependent on the mechanism by which the structure collapses. Much of the experimental work on the energy absorption of composite materials has been restricted to the axial compression of axisymmetric cylindrical tubes. One end of the tube is chamfered to initiate crushing. Failure starts at the chamfer tip, and the damage zone propagates down the tube without catastrophic fracture [2,3]. Many investigations have been carried out to determine the effects of tube geometry [4,5], fiber architecture [6,7] fiber type [8], resin type [9,10], and Kerth et al. [11] and testing conditions [10,12–16] on the energy absorption capability.
Hamada et al. [9] concluded that thermoplastic composite tubes (carbon/PEEK) absorb higher energies than thermoset composite tubes (carbon/epoxy). Hamada et al.[13] found that quasi-statically tested tubes displayed higher specific energy absorption than impact-tested tubes for carbon (PEEK) composite.

Furthermore, Hamada [17] developed a calculation method to predict the mean crushing load. The method was applied to glass-fiber-cloth/ epoxy and carbon-fiber/ PEEK composite tubes. He concluded that the predicted values were similar to the experimental values for glasscloth/ epoxy while the difference is large for the carbon/ PEEK composites.

Work on axial compression of axisymmetric tubes to be used in energy absorbing applications has been extended to cones by Price et al. [18]. Their study concentrated on the axial crushing of glass-fiber/polyester composite cones. They concluded that, for cones with a wall thickness greater than 2 mm, a progressive crushing failure type would occur starting at the small end unlike tubular specimens, no trigger being necessary for cones. The specific energy absorption varies with cone angle, wall thickness and diameter in a complex way and in some cases exceeds the values recorded for axisymmetric tubes. The crush zone morphology and failure micromechanisms also vary with specimen geometry. An initial assessment has been made for the relationship between energy absorption and failure mode.
1.2 OBJECTIVES
i. To analyses behaviors of different angle of composite cone under compression load.
ii. To analyze the performance of composite cone in energy absorption point of view

1.3 SCOPES OF PROJECT
i. To determine the fabrication angles for cone
ii. To study the compression test behaviors of composite cones
iii. To analyses energy absorption of composite cones

1.4 PROBLEM STATEMENT

In passenger vehicles the ability to absorb impact energy and be survivable for the occupant is called “crash worthiness” of the structures. The challenge is determining what specific design features are needed in the geometry and what material systems will enable greater safety without negatively affecting the overall economics of fabrication and production. So this is the usage of the shape of composite cone in automotive field.