CHAPTER 1

INTRODUCTION

1.1 PROJECT BACKGROUND

Sheet metal forming is a process shaping by applying force to the blank. Metal forming is used for achieving complex shape products and improving the strength of the material. During forming, little material is wasted compared to other manufacturing processes and deep drawing is one of the metal forming processes, where In the deep drawing process, flat sheet of metal (called blank) is placed over the die, and with the help of the punch, blank is pressed into the die cavity. Blank holder applies pressure to the blank in the flange region during the deep drawing process. This method is widely used for producing various products in different places of industry. The parts manufactured by sheet metal forming are widely used in automotive and aircraft industries. Sheet metal forming is very important for metals because nearly 50% of metals is produced in sheet metals (Grote K.-H., Antonsson E.K., 2008.)

Deep drawing is affected by many factors, like material properties, tool selection, and lubrication. Because of these factors, some failures may occur during the process and flange wrinkling are one of the failure types that can be seen in deep drawing, and the cause of this failure caused by compressive stresses. A part flange wrinkled during the deep drawing process, will not be accepted and most likely become a scrap, a total waste of both money and time. Because of these reasons, wrinkling must be prevented. There are two main methods used in order to prevent flange wrinkling. The former is using a blank holder and blank holder is a tool used for preventing the edge of a sheet metal part from flange wrinkling.
There is one type blank holder that is used namely, pressure blank holder. In the former, the sheet metal kept at several of thickness, by adjusting variable force between blank and die during the process, and flange wrinkling is prevented. In the latter, force is applied to the blank from the blank holder, called blank holder force (BHF), in order to prevent flange wrinkling. Adjusting the force and thickness of blank that is suitable is very important, because high or low force and thickness of blank that is not suitable will be cause of fracture at the cup wall and low (BHF) leads to wrinkling in the flange of the cup.

![Deep Drawing Process Diagram](image)

**Figure 1.1:** Deep Drawing Process


### 1.2 PROBLEM STATEMENT

In manufacturing processes the main goal is to obtain defect free end product. The first step of manufacturing is the designing process, which enormously affects the whole manufacturing process. The designer must have knowledge about possible problems and their solutions during production. Many researchers have been completed in various manufacturing processes because of the knowledge needed to achieve better quality product. This study helps to improve the performance of deep drawing process by using suitable parameter to reduce wrinkling in product. It is worth to understand the capability of punch force, blank of thickness and blank holder force during deep drawing process. This thesis will discuss about flange wrinkling problem and its prevention in the deep drawing process.
1.3 PROJECT OBJECTIVE

The objectives of this research are as following:

i. Study the effect of force, blank of thickness and blank holder force parameters on the flange wrinkling to reduce the flange wrinkling.

ii. Develop flange regression study interaction between force, thickness parameters and blank holder force which are termed response flange methodology.

1.4 SCOPE OF PROJECT

In this project, sheet metal is used as a specimen. The specification of the sheet metal will be identified using surface measurement. Deep drawing operation is performed using die. Deep drawing operation will be done on sheet metal based on force that is applied, blank of thickness and blank holder force. In this case spring of blank holder force is set base on calculation throughout the experiments. The flange wrinkles of each of the specimen will be studied and compared.

1.4.1 Project Specification

- Sheet metal material : Mild steel with 320GPa Young Modulus of Elasticity
- Thickness of blank : 1mm, 2mm,
- Size of die : 280mm x 280mm (L-R x F-B)
- Blank size : Ø105mm
- Diameter of cup : 50mm (outer diameter)
- Part draw height : 10 and 20mm
- Cup outer radius : 5mm
- Machine tonnage : 80 tonne