**CHAPTER ONE**

**INTRODUCTION**

In metal cutting operations, cutting tool life is one of the most important aspects. The performance of a cutting tool normally assessed in terms of its life. Cutting tools are subjected to high localized stresses at the tip of the tool, high temperatures, especially along the rake face, sliding of the chip along the rake face, and sliding of the tool along the newly cut work piece surface. These conditions induce tool wear, which is a major consideration in all machining operations. Tool wear adversely affects tool life, the quality of the machined surface and its dimensional accuracy, and, consequently, the economics of cutting operations. Tool life is defined as the length of cutting time that the tool can be used. Operating the tool until final catastrophic failure is one way of defining tool life . In production, it is often a disadvantage to use the tool until this failure occurs because of difficulties in retargeting the tool and problems with work part quality. As an alternative, a level of tool wear can be selected as a criterion of tool life, and the tool is replaced when wear reaches that level. A convenient tool life criterion is a certain flank wear value, such as 0.5 mm. In order to establish an adequate functional relationship between the tool life and the cutting parameters (cutting speed, feed, and depth of cut), a large number of tests are needed, requiring a separate set of tests for each and every combination of cutting tool and work piece material. This increases the total number of tests and as a result the experimentation cost also increases. [1]

The present work is concerned with developing a statistical model that relating the input variables : rotational speed (N) , feed (F),and depth of cut (D) with the dependent variable, tool life. This model can be used to understand the nature of the relationship between these input variables and tool life, and also estimate tool life within the studied range . An experiment has been designed based on Box-Behnken design technique.

This technique requires fewer experimental data sufficient to establish a second-order polynomial linking the response to the input variables utilizing the Taguchi. The developed model has been analyzed and checked by testing the significance of the regression coefficients. The effects of individual input variables and their significant interaction on tool life have been studied and presented graphically.