Reducing Machining Time by Using Modern Manufacturing Software

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***Abstract* - By implementing feature-based CAM software from Delcam and investing in CNC mills, the industries can be able to reduce machining time and part programming time. Determined to be competitive not only in quality but also in manufacturing methods, the manufacturing companies are upgrading their capability with the help of Delcam software to take models of their components from 3D modeling software's to production quickly. Typical machining tolerances in the specified range can be consistently achieved. In this thesis, the time taken to manufacture the main housing used in weighing machine is estimated. Main Housing is drawn in 3D Modeling and feature based software Pro/Engineer. The time taken for modeling, part programming and machining time using software's Pro/Engineer and Delcam is compared and analyzed in this thesis. Models of the casing will be drawn in 3D Modeling and feature based software Pro/Engineer. The models are e imported in to the feature based CAM software Delcam. The time reduction using the software's for modeling, part programming and machining time is analyzed in this thesis.**

I. INTRODUCTION

Machining is any of various processes in which a piece of raw material is cut into a desired final shape and size by a controlled material-removal process. The many processes that have this common theme, controlled material removal, are today collectively known as subtractive manufacturing, in distinction from processes of controlled material addition, which are known as additive manufacturing. Exactly what the "controlled" part of the definition implies can vary, but it almost always implies the use of machine tools (in addition to just power tools and hand tools).

The precise meaning of the term machining has evolved over the past one and a half centuries as technology has advanced. In the 18th century, the word machinist simply meant a person who built or repaired machines. This person's work was done mostly by hand, using processes such as the carving of wood and the hand-forging and hand-filing of metal. At the time, millwrights and builders of new kinds of engines (meaning, more or less, machines of any kind), such as James Watt or John Wilkinson, would fit the definition. The noun machine tool and the verb to machine (machined, machining) did not yet exist. Around the middle of the 19th century, the latter words were coined as the concepts that they described evolved into widespread existence. Therefore, during the Machine Age, machining referred to (what we today might call) the "traditional" machining processes, such as turning, boring, drilling, milling, broaching, sawing, shaping, planning, reaming, and tapping. In these "traditional" or "conventional" machining processes, machine tools, such as lathes, milling machines, drill presses, or others, are used with a sharp cutting tool to remove material to achieve a desired geometry. Since the advent of new technologies such as electrical discharge machining, electrochemical machining, electron beam machining, photochemical machining, and ultrasonic machining, the retronym "conventional machining" can be used to differentiate those classic technologies from the newer ones. In current usage, the term "machining" without qualification usually implies the traditional machining processes.

Machining is a part of the manufacture of many metal products, but it can also be used on materials such as wood, plastic, ceramic, and composites. A person who specializes in machining is called a machinist. A room, building, or company where machining is done is called a machine shop. Machining can be a business, a hobby, or both. Much of modern day machining is carried out by compute. Computer numerical control (CNC), in which computers are used to control the movement and operation of the mills, lathes, and other cutting machines.

II. MODELLING IN PRO-E

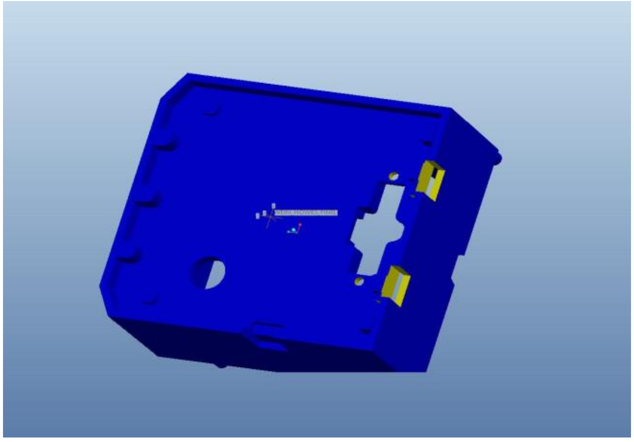

Fig: 2.1 3D Model of Main Housing

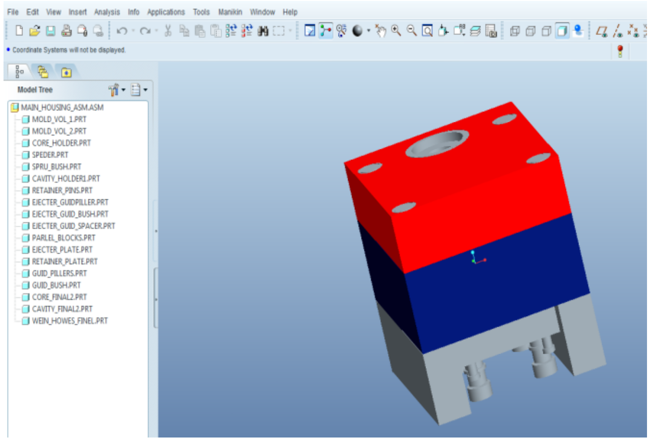

Fig: 2.2 Die Assembly Of Main Housing

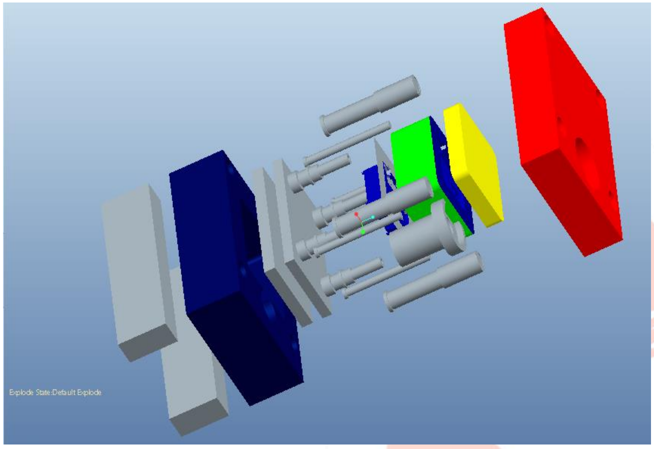

Fig 2.3: Exploded View

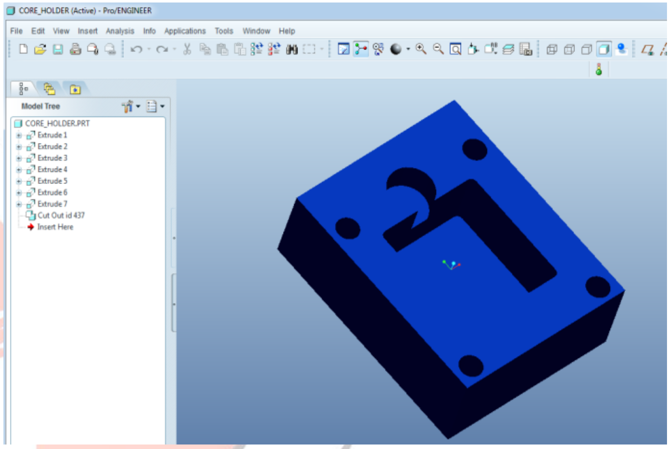

Fig: 2.4 Core Holder Plate

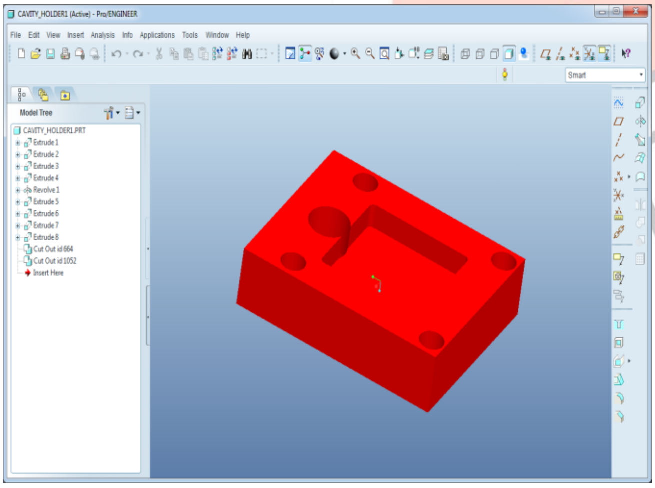

Fig: 2.5 Cavity Holder Plate

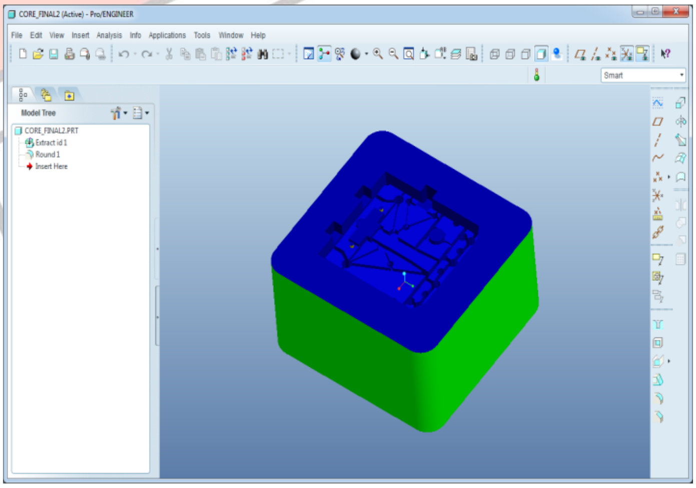

Fig: 2.6 Core Insert Plate

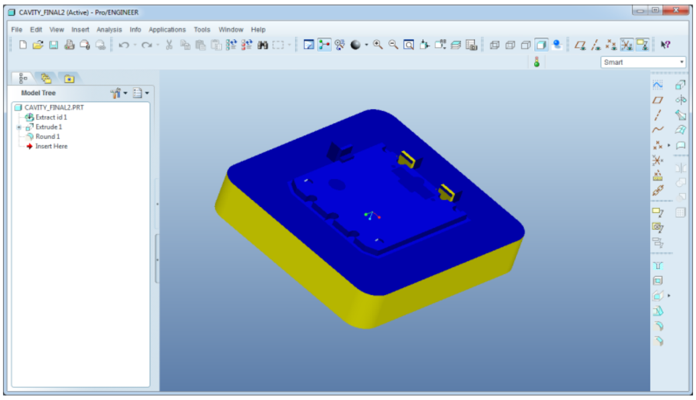

Fig: 2.7 Cavity Insert Plate

III. MANUFACTURING PROCESS IN PRO-E

3.1 Roughing

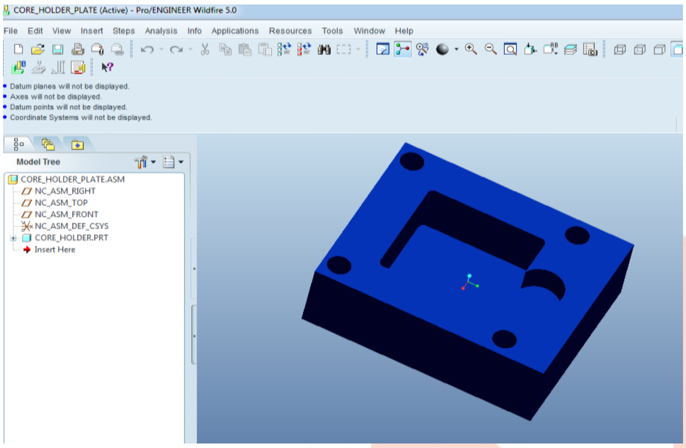

Fig: 3.1 Core Holder Plate

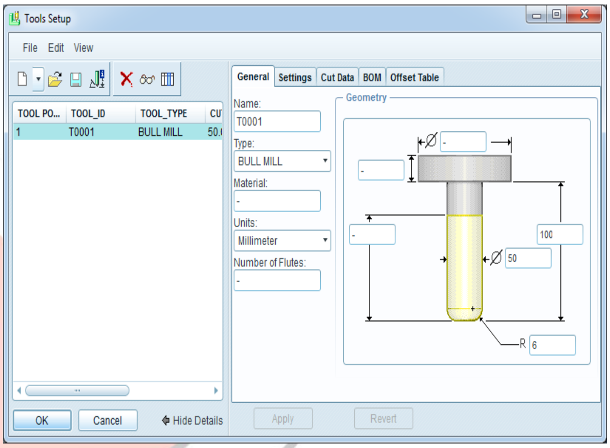

Fig: 3.2 Tool Set up for Roughing

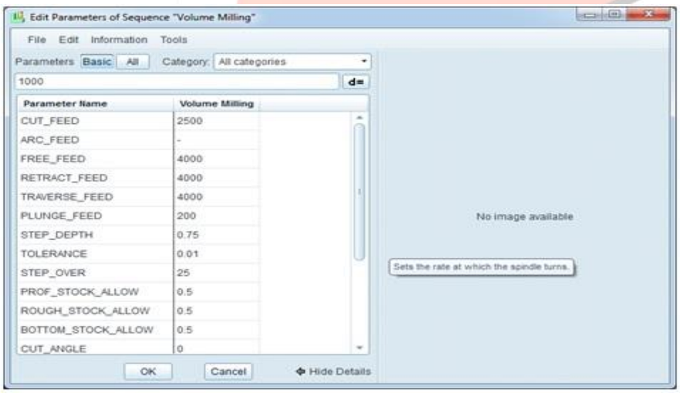

Fig: 3.3 Editing Parameters for Roughing

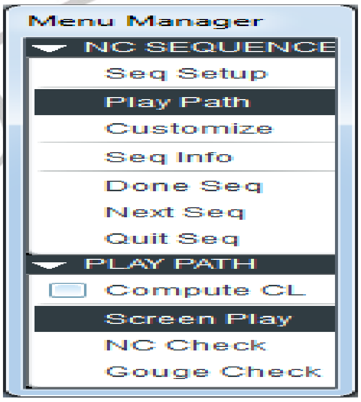

Fig 3.4: Menu Manager in Pro-E

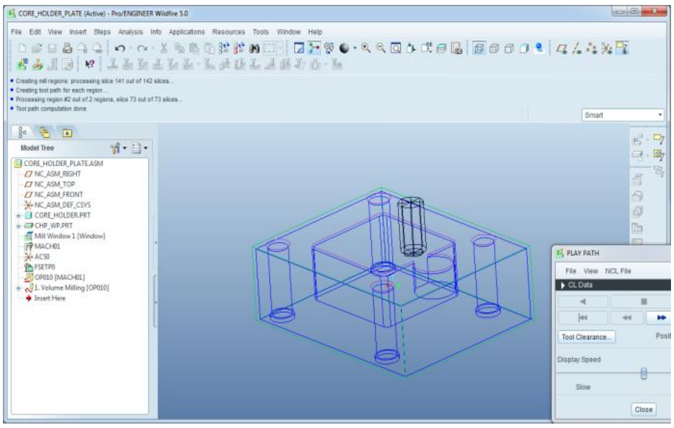

Fig 3.5: Machined Core Holder Plate

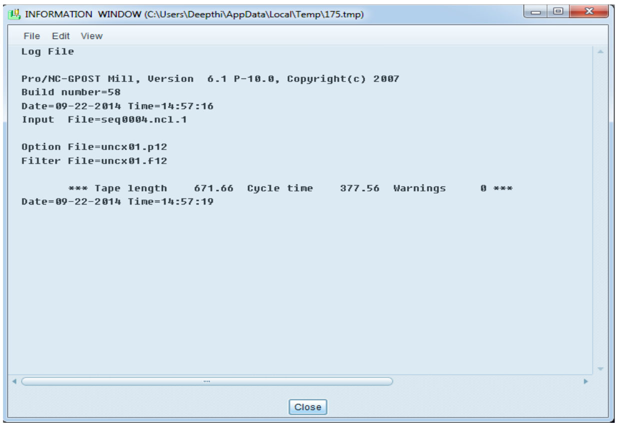

Fig 3.6: Information Window for Roughing in Pro-E

3.2 Finishing

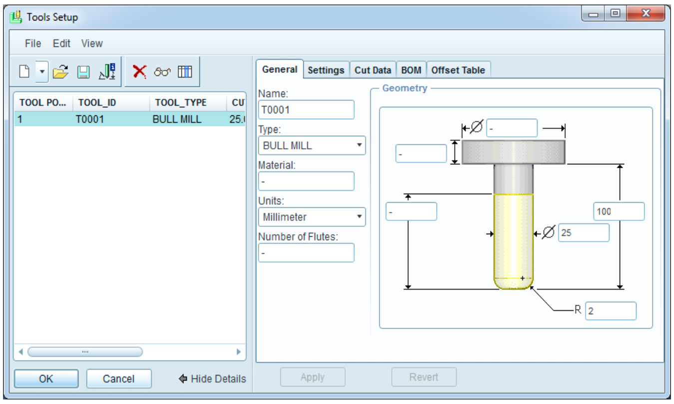

Fig: 3.7 Tool Setup for Finishing

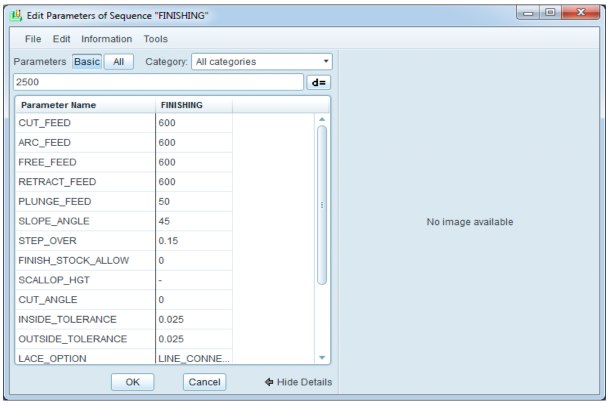

Fig: 3.8 Editing Parameters for finishing

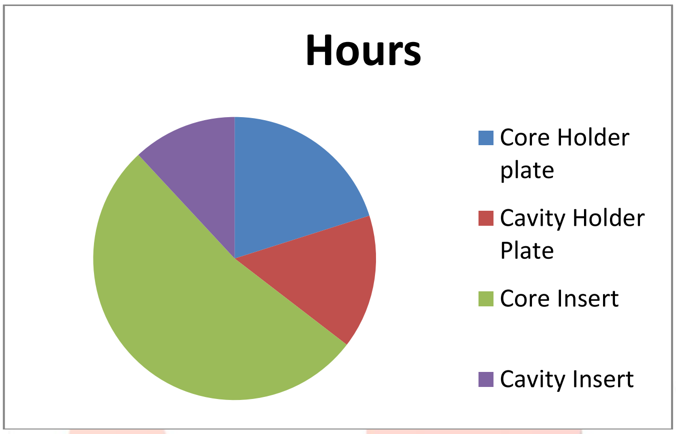

Fig 3.9: Pie chart for Machining Time Using Pro/Engineer

IV. MANUFACTURING PROCESS USING DELCAM

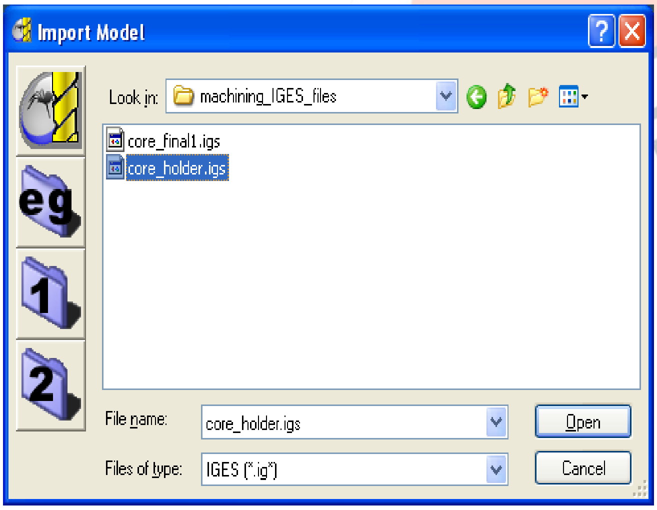

Fig: 4.1 Import Model from Pro-e to Delcam

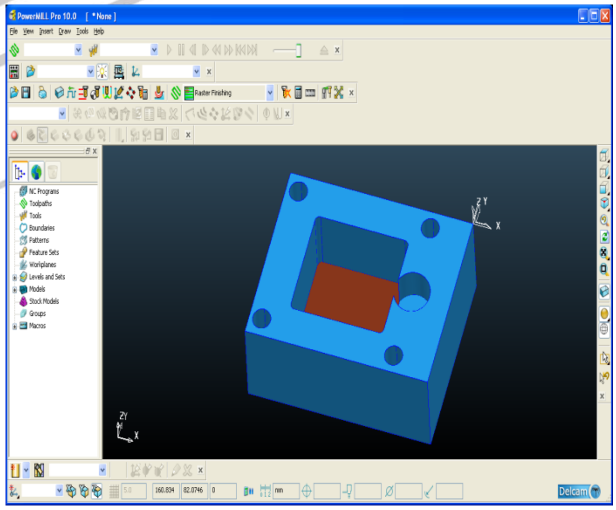

Fig: 4.2 Imported Model of Power Mill from Pro-e to Delcam

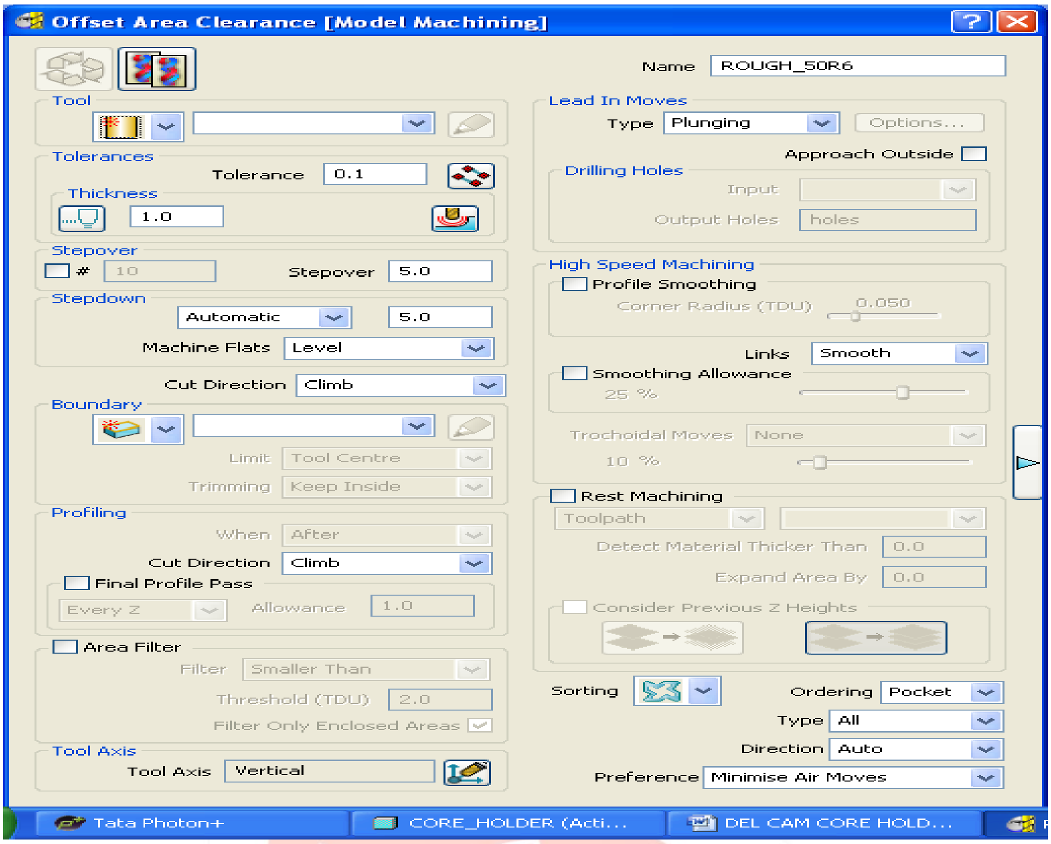

Fig: 4.3 Offset Area Clearance (Model Machining)

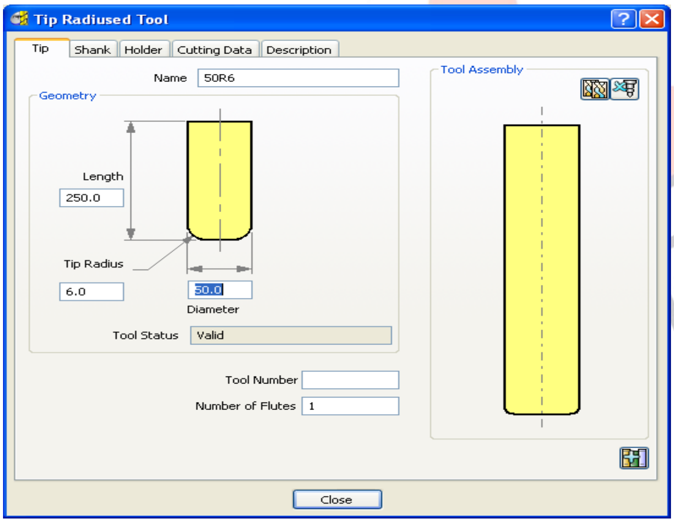

Fig: 4.4 Tip Radiused Tool

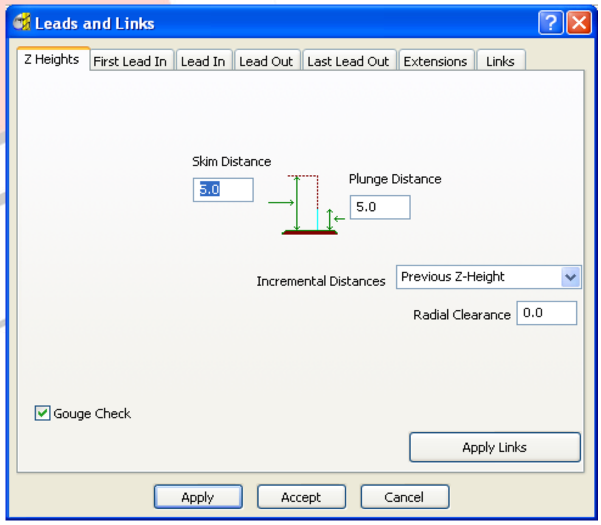

Fig: 4.5 Leads and Links

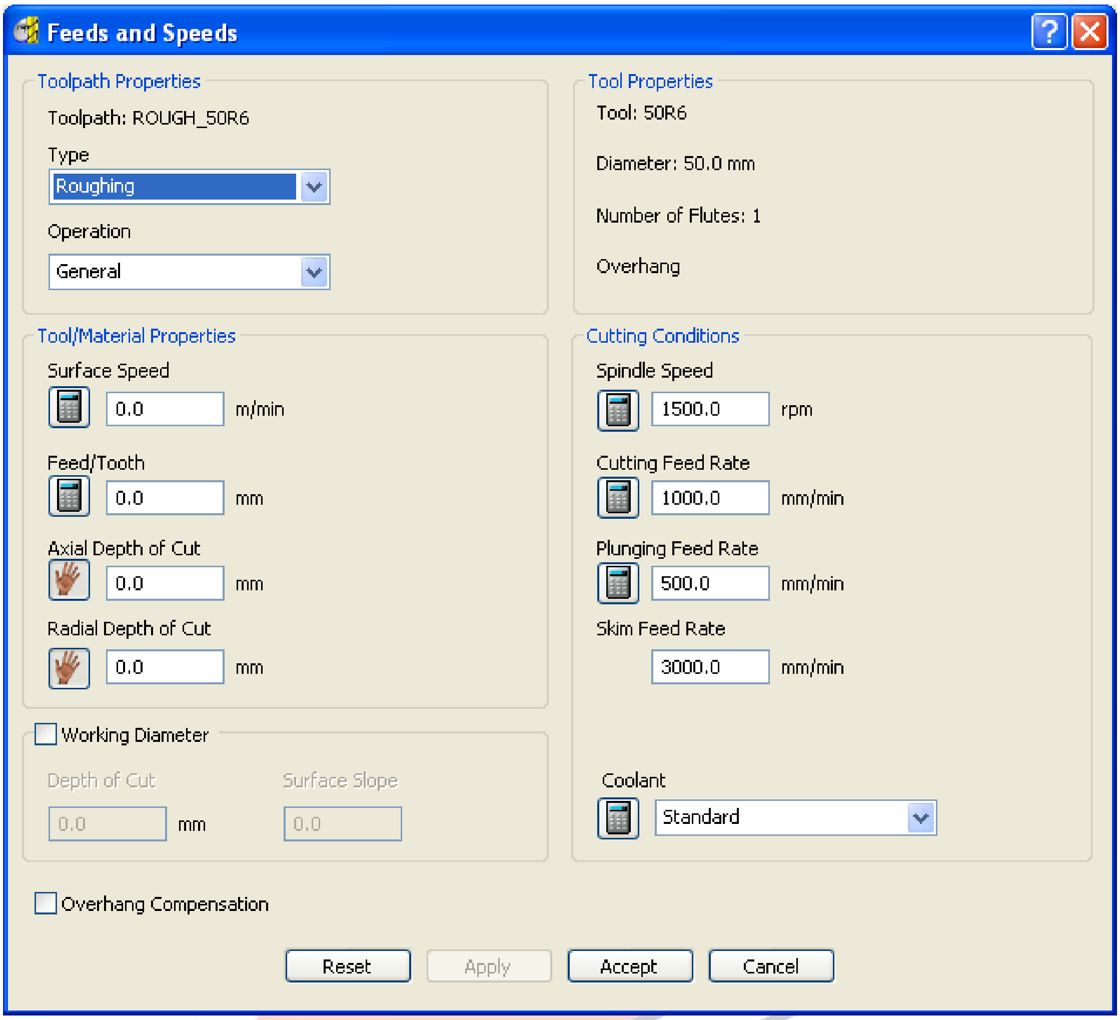

Fig: 4.6 Feeds and Speeds from Delcam

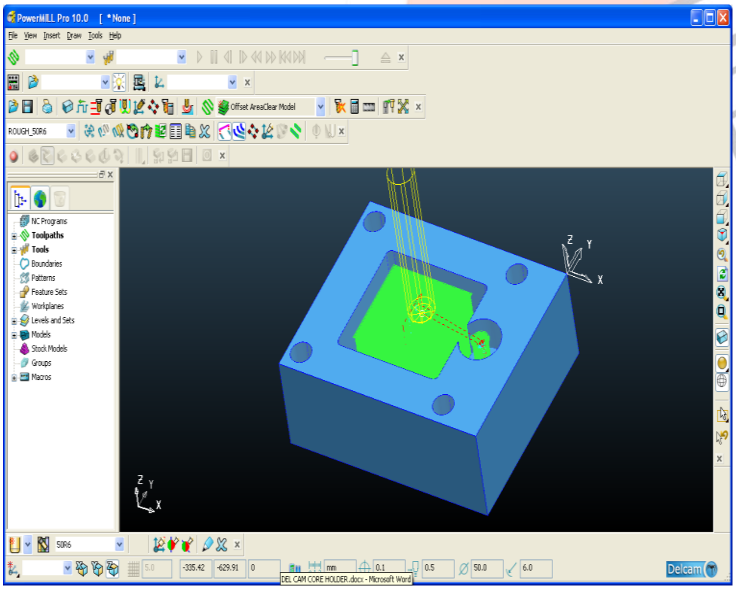

Fig: 4.7 Power mill Model after Machining

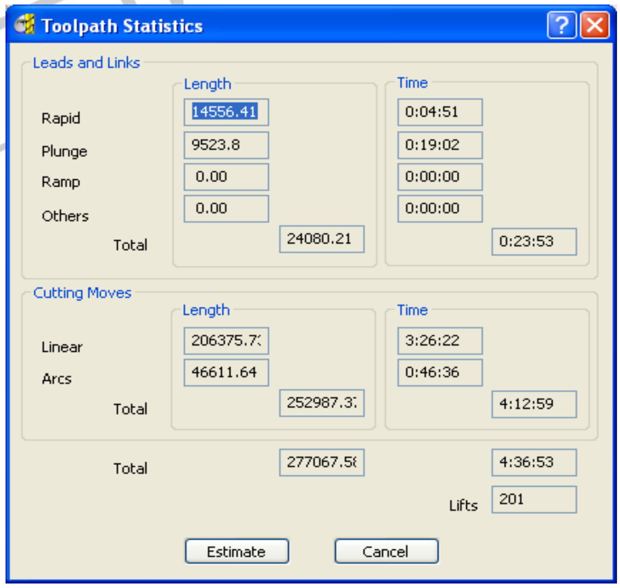

Fig: 4.8 Tool Path Statistics from Delcam

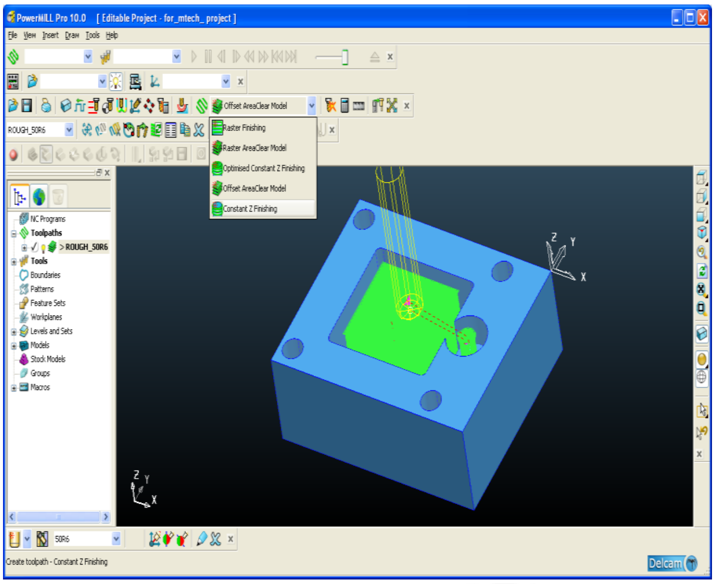

Fig: 4.9 Power mill Model during Finishing Operation

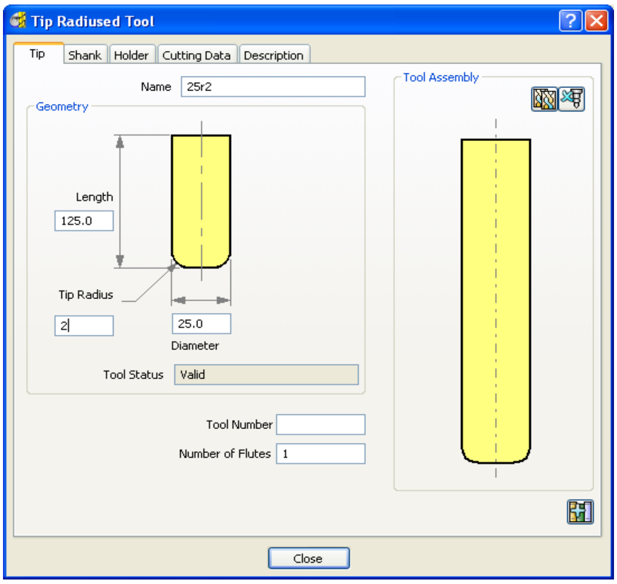

Fig: 4.10 Tip Radiused tool during Finishing Operation

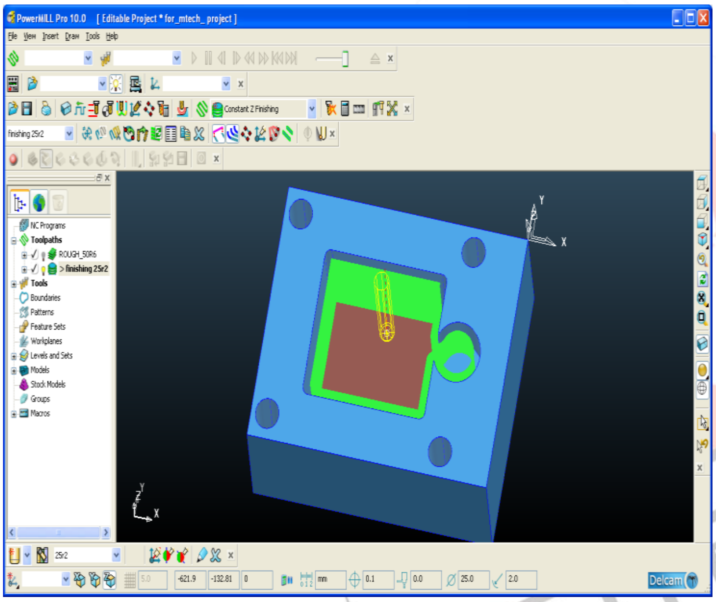

Fig 4.11 Pie chart for Machining Time using Delcam

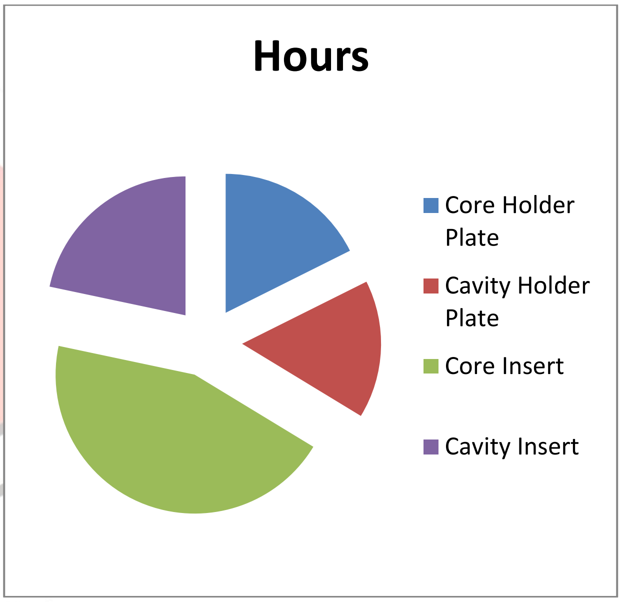

Fig: 4.12 Power mill Model after Machining

V. RESULTS AND SUMMARY

5.1 TABULAR FORM

TABLE 5.1: COMPARISON FOR MACHINING TIME BETWEEN PRO/E AND DELCAM FOR ROUGHING

Die Parts	Pro/E	Delcam	Time save (%)age
Core Holder Plate	6’ 29’’	2’ 09’’	67%
Cavity Holder Plate	4’ 15’’	2’ 04’’	52%
Core Insert	12’ 10’’	6’ 20’’	48%
Cavity Insert	2’ 34’’	45’’	71%

Table 5.2: Comparison for Machining Time between Pro/E and delcam for Finishing

Die Parts	Pro/E	Delcam	Time save (%)age
Core Holder Plate	3’ 19’’	2’ 28’’	26%
Cavity Holder Plate	3’ 13’’	2’ 08’’	34%
Core Insert	13’ 30’’	5’ 20’’	60%
Cavity Insert	3’ 15’’	1’ 35’’	51%

Table 5.3 Comparison for Machining Time between Pro/E and Delcam for Complete part

Die Parts	Pro/E	Delcam	Time save (%)age
Core Holder Plate	9’ 48’’	4’ 37’’	53%
Cavity Holder Plate	7’ 28’’	4’ 12’’	44%
Core Insert	25’ 40’’	11’ 40’’	35%

Cavity Insert	5’ 49’’	2’ 20’’	60%

5.1 Graphs

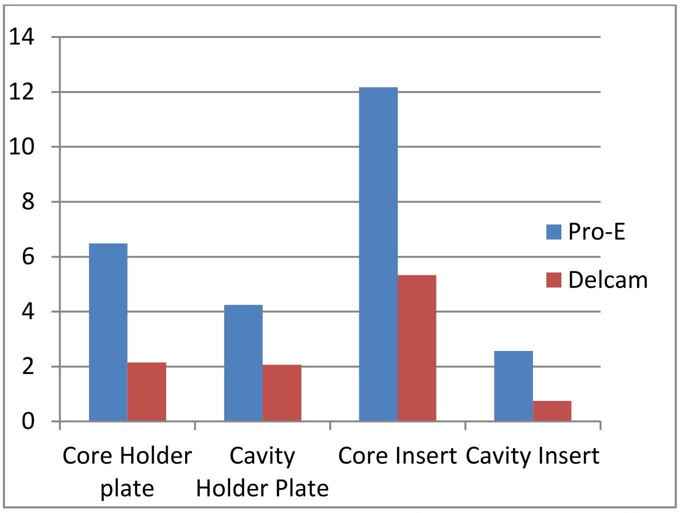

Fig 5.1 Comparison for Machining Time between Pro/E And Delcam for Roughing

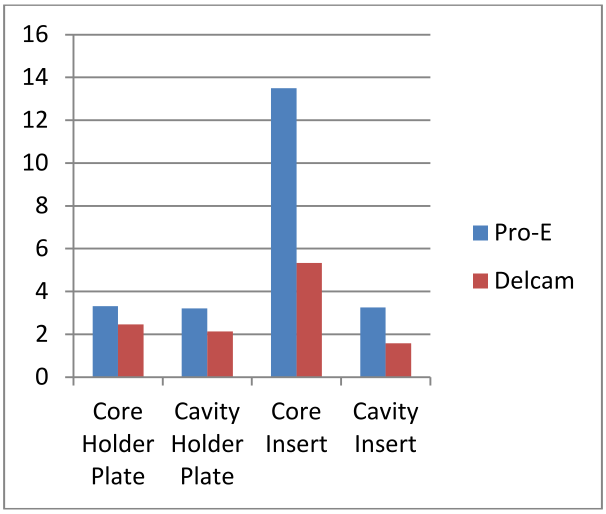

Fig 5.2 Comparison for Machining Time between Pro/E And Delcam for Finishing

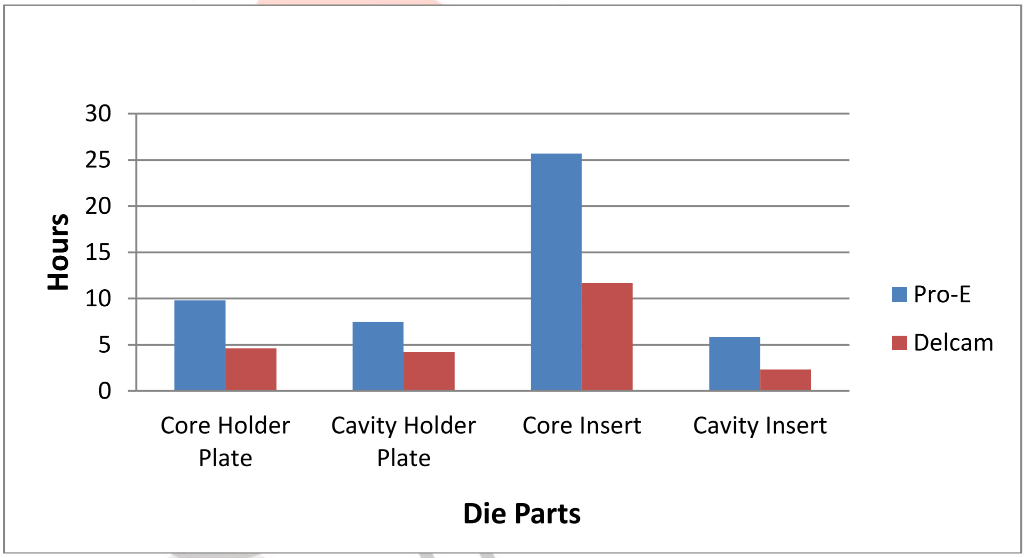

Fig 5.3 Comparison for Machining Time between Pro/E and Delcam for Finishing

VI. Conclusion

In this thesis, a die for a casting component used in weighing machine is designed in Pro/Engineer. The die parts core holder plate, cavity holder plate; core insert and cavity insert are to be machined.

The manufacturing process is done in both Pro/Engineer and Delcam. The machining time is analyzed and compared for both the software’s. By observing, by performing manufacturing process in Delcam, the machining time is reduced when compared with that of Pro/Engineer. This is because, in Delcam, the non cutting paths are not considered. The machining time for roughing and finishing are still reduced by changing the original parameters.

The finishing process in Pro/Engineer takes more time since it considers the time of roughing also which is a disadvantage. So using manufacturing software Delcam reduces **54%** of the machining time and is a better tool than Pro/Engineer.

References

[1] Pro-E 5.0 Manual
[2] Delcam Manual
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[4] Marina Novak, BojanDolsak, Intelligent FEA-based design improvement, journal of Engineering Applications of Artificial Intelligence, volume 21, pages 1239– 1254,2008.
[5] Technical drawings from JDP Tool Tech Workshop.