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 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, and ultrasonic machining, the retronym "conventional 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

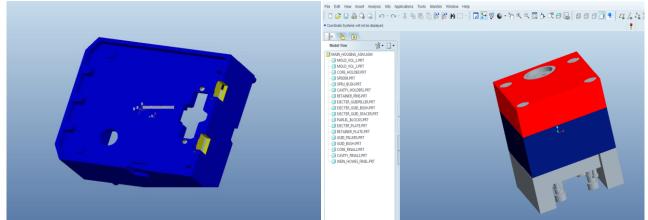


Fig: 2.1 3D Model of Main Housing

Fig: 2.2 Die Assembly Of Main Housing

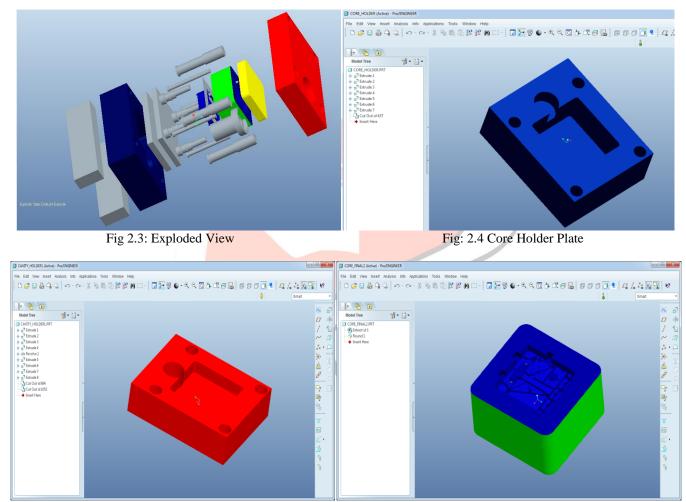


Fig: 2.5 Cavity Holder Plate

Fig: 2.6 Core Insert Plate

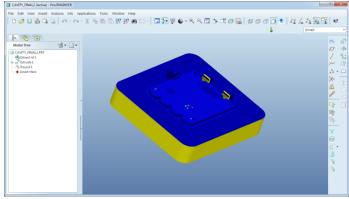


Fig: 2.7 Cavity Insert Plate

III. MANUFACTURING PROCESS IN PRO-E

3.1 Roughing

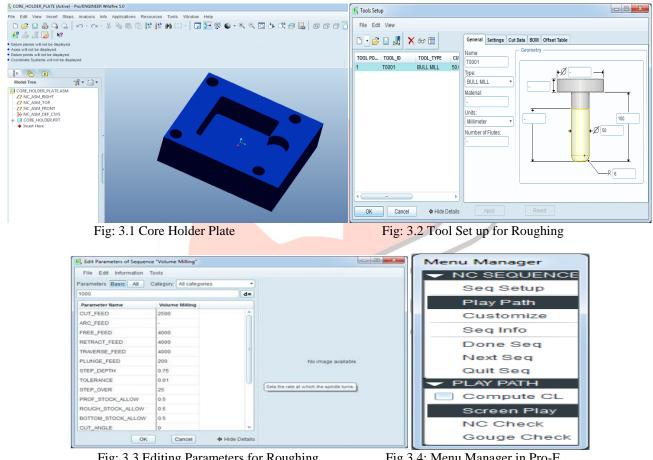
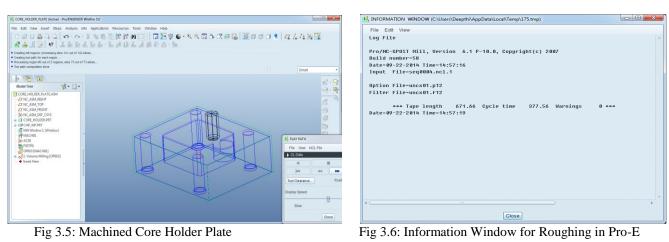


Fig: 3.3 Editing Parameters for Roughing

Fig 3.4: Menu Manager in Pro-E



3.2 Finishing

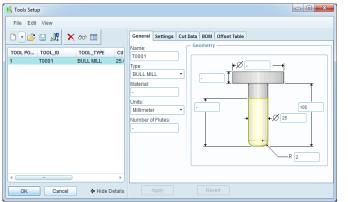
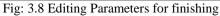
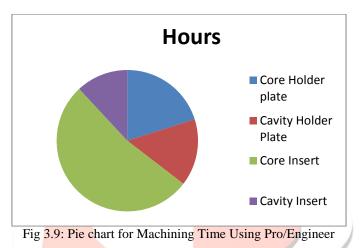


Fig: 3.7 Tool Setup for Finishing

File Edit Information	Tools	
Parameters Basic All	Category: All categories	•
2500		d=
Parameter Name	FINISHING	
CUT_FEED	600	â
ARC_FEED	600	
FREE_FEED	600	
RETRACT_FEED	600	
PLUNGE_FEED	50	
SLOPE_ANGLE	45	No image available
STEP_OVER	0.15	
FINISH_STOCK_ALLOW	0	
SCALLOP_HGT	-	U
CUT_ANGLE	0	
INSIDE_TOLERANCE	0.025	
OUTSIDE_TOLERANCE	0.025	
LACE_OPTION	LINE_CONNE	•





IV. MANUFACTURING PROCESS USING DELCAM



Fig: 4.1 Import Model from Pro-e to Delcam

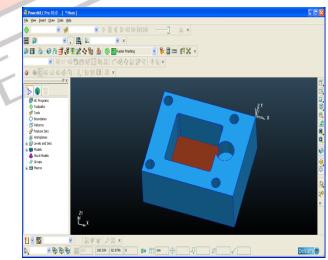


Fig: 4.2 Imported Model of Power Mill from Pro-e to Delcam

	Name ROUGH_50R6
	Lead In Moves Type Plunging V Options
Tolerances Tolerance 0.1	Approach Outside
Thickness	Input
	Output Holes holes
Stepover	Likeb General Markinian
# 10 Stepover 5.0	High Speed Machining Profile Smoothing
Stepdown Automatic V 5.0	Corner Radius (TDU) 0.050
Machine Flats Level	
	Links Smooth Smoothing Allowance
Cut Direction Climb	25 %
	Trochoidal Moves None
Limit Tool Centre	
Trimming Keep Inside 🗸	
Profiling	Rest Machining
When After 🗸	Detect Material Thicker Than 0.0
Cut Direction Climb	
Final Profile Pass	Expand Area By 0.0
Every Z 💊 Allowance 1.0	Consider Previous Z Heights
Area Filter	
Filter Smaller Than 😪	
Threshold (TDU) 2.0	Sorting Sorting Ordering Pocket
Filter Only Enclosed Areas 💌	Type All
Tool Axis	Direction Auto
Tool Axis Vertical	Preference Minimise Air Moves
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Fig: 4.3 Offset Area	(
Fig: 4.3 Offset Area	
Fig: 4.3 Offset Area	Leads and Links
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Fig: 4.4 Tip Radiused Tool

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Fig: 4.5 Leads and Links

of Feeds and Speeds	28
Toolpath Properties Toolpath: ROUGH_50R6 Type Roughing Operation General	Tool Properties Tool: 50R6 Diameter: 50.0 mm Number of Flutes: 1 Overhang
Tool/Material Properties Surface Speed Image: Contemportal structure Image: Contemportal structure <tr< th=""><th>Cutting Conditions Spindle Speed 1500.0 rpm Cutting Feed Rate 1000.0 mm/min Plunging Feed Rate 500.0 mm/min Skim Feed Rate 3000.0 mm/min</th></tr<>	Cutting Conditions Spindle Speed 1500.0 rpm Cutting Feed Rate 1000.0 mm/min Plunging Feed Rate 500.0 mm/min Skim Feed Rate 3000.0 mm/min
0.0 mm Working Diameter Depth of Cut Depth of Cut Surface Slope 0.0 mm 0.0 mm 0.0 mm 0.0 Reset Apply	Coolant Standard Accept Cancel
	d Speeds from Delcam
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	Arcs 46611.64 0:46:36 Total 252987.3: 4:12:5 Total 277067.58 4:36:5
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Fig: 4.7 Power mill Model after Machining

Fig: 4.8 Tool Path Statistics from Delcam

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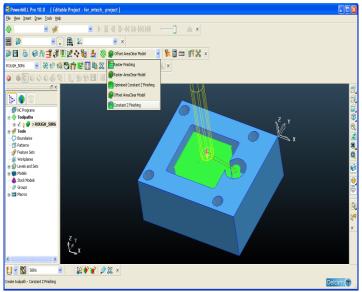
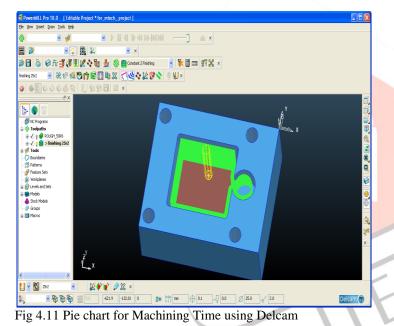
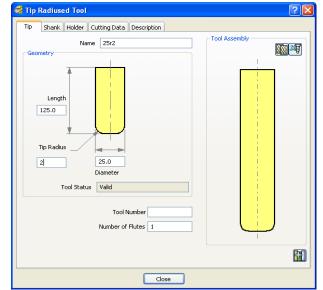
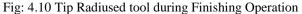


Fig: 4.9 Power mill Model during Finishing Operation







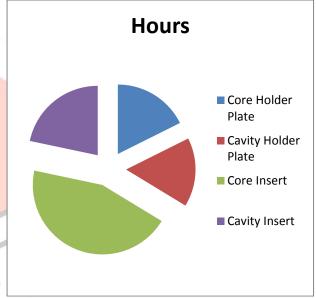


Fig: 4.12 Power mill Model after Machining

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

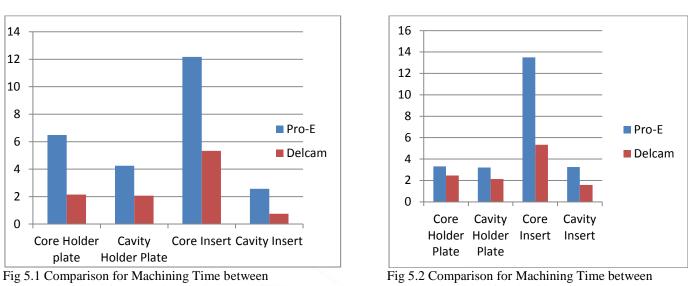
Die Parts	Pro/E	Delcam	Time save (%)age
Core Holder Plate	3' 19''	2' 28''	26%
Cavity Holder Plate	3' 13''	2' 08''	34%
Core Insert	13' 30''	5' 20''	60%
Cavity Insert	3' 15''	1' 35''	51%

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%
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5.1 GRAPHS



Pro/E And Delcam for Roughing

Pro/E And Delcam for Finishing

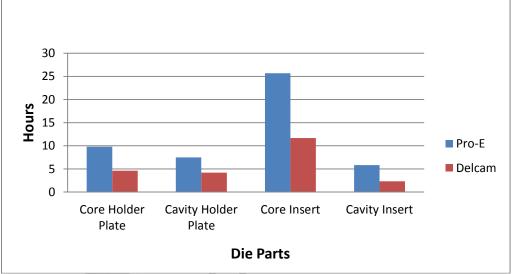


Fig 5.3 Comparison for Machining Time between Pro/E and Delcam for Finishing

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.

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