



DESIGN SIMULATION AND MANUFACTURING OF A COMPONENT IN CNC LATHE MACHINE USING CNC PROGRAM

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Abstract : The objective is to machine the raw material to given dimensions which consists of step turning, fillet and chamfer machining operations. The methodology used in machining is CNC program that consists alphanumeric codes (G-CODES & M-CODES) in FANUC controller and the excess material is removed. The aim is to improve the accuracy of the component in terms of dimension & shape using CNC machine.

keywords : CNC Lathe Machine , EMCO Launch Simulator , Autocad ,CREO, Mild steel , Vernier callipers.

INTRODUCTION:

Computerized Numerical Control (CNC) machines are used in manufacturing parts with improved accuracy . Similarly, CNC machine consists of turret which consists several tools fixed in it which reduces the tool changing time as well as the unproductive time . By the help of alphanumeric codes program is written in the EDIT mode and given as input to the machine to perform machining operations as of the required dimensions & shape by removing the unwanted material. The tool is fixed in turret and the chuck holds the work piece. As per the CNC program the machining is done and the coolant is allowed to fall on the workpiece and the insert of tool to overcome the heat produced which increases the life of the insert.

LITERATURE REVIEW :

- 1.Linyan Liu et al.** (2014) presents a knowledge-centric process management framework for the CNC machine tool design and development (D&D) with the integration of process and knowledge.
- 2.Dr.J.B. Jayachandraiah et al** (2014) provide the idea to develop the low cost system which is capable of 3 axis simultaneous interpolated. The low cost is achieved by incorporating the features of standard PC interface with microcontroller base CNC system in an Arduino based embedded system.
- 3.Ahmed A.D.Sarhan et al.** (2015) in this paper, an initial CNC milling machine & turning machine structure with the potential to produce high surface finish has been designed and analyzed.
- 4.Sundar Pandian et al. (2014)** develop low cost 3 axis CNC machine using of- the- shelf component, stepper motors with drivers.

MATERIAL SELECTION:

The material selected for machining the component according to the given geometry is mild steel (MS).

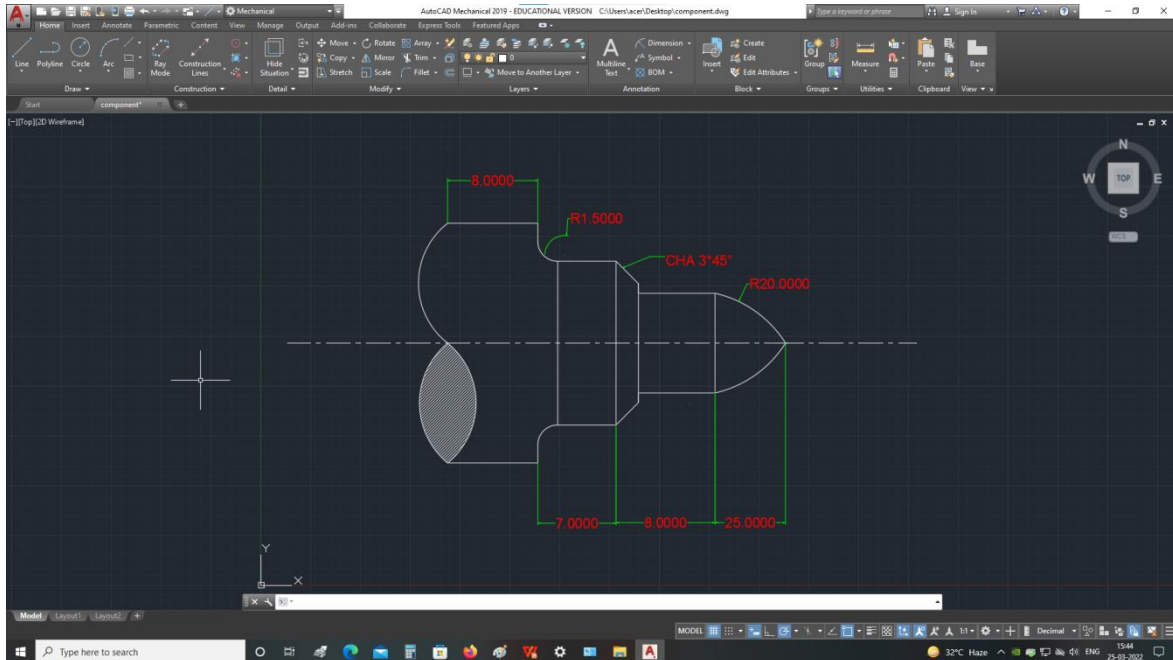
- Properties possessed by the mild steel are ductile, cost-effective, high tensile strength, high impact strength.

CNC LATHE MACHINE SPECIFICATIONS:

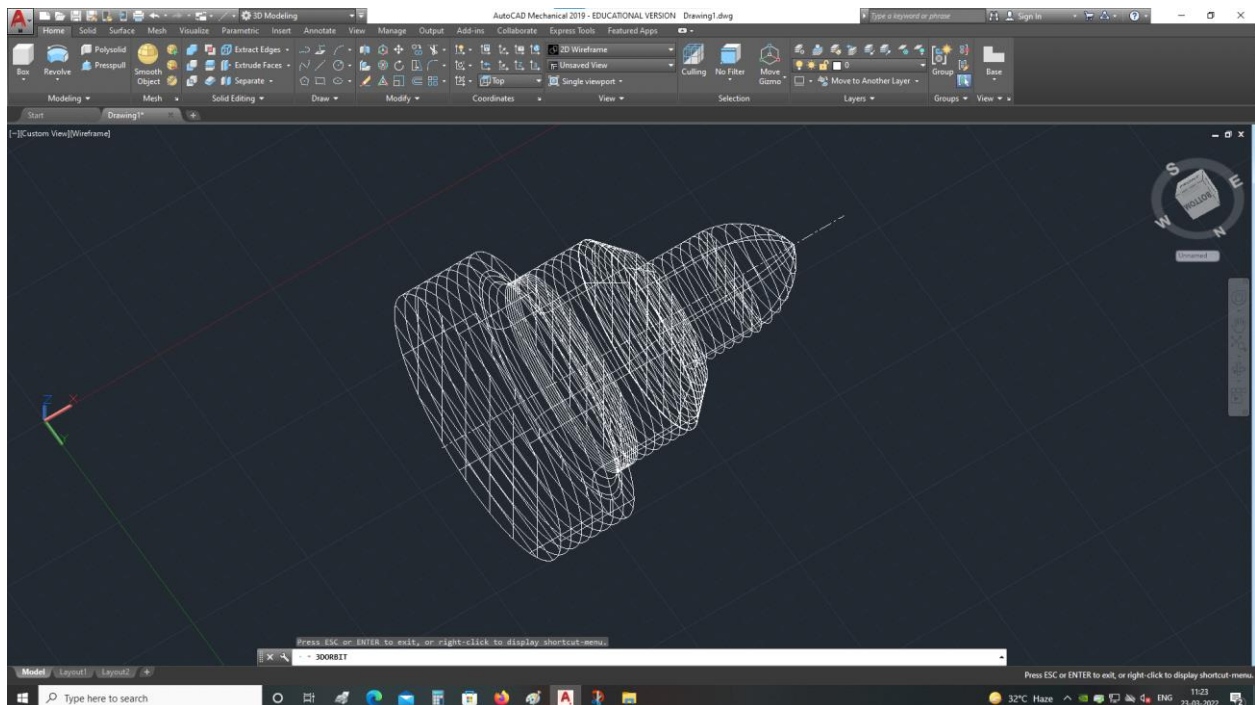
CONTROLLER NAME : FANUC Series Oi mate-TF
MAKE : ACE Designers
SPECIFICATION : D*L = (320*400)mm
ACCURACY :10 MICRON

TWO DIMENSIONAL DRAFTING OF GIVEN COMPONENT

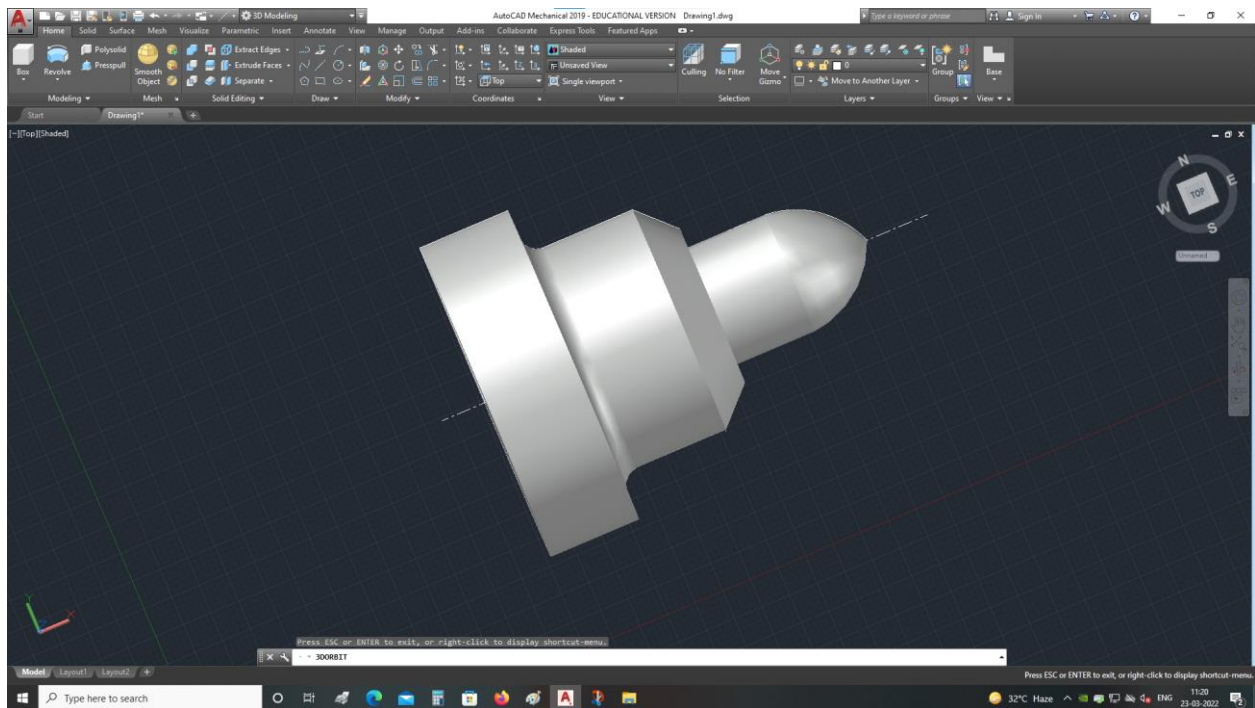
(Defined Geometry):



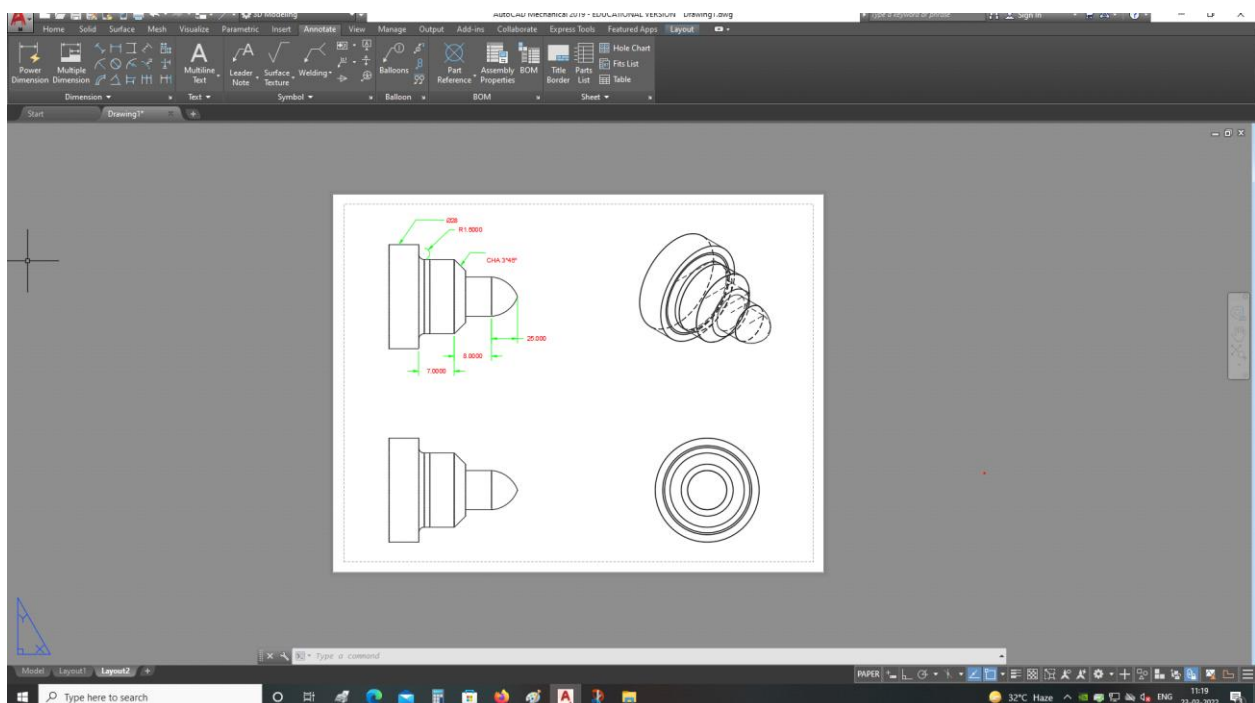
WIREFRAME MODEL:



THREE DIMENSIONAL MODEL:



BASIC LAYOUT MODEL:



DESCRIPTION:

The given component of defined geometry consists of step turning, fillet & chamfer operations to be performed on given raw material to obtain finished product of defined geometry (shape, size, dimension).

SOFTWARE USED :

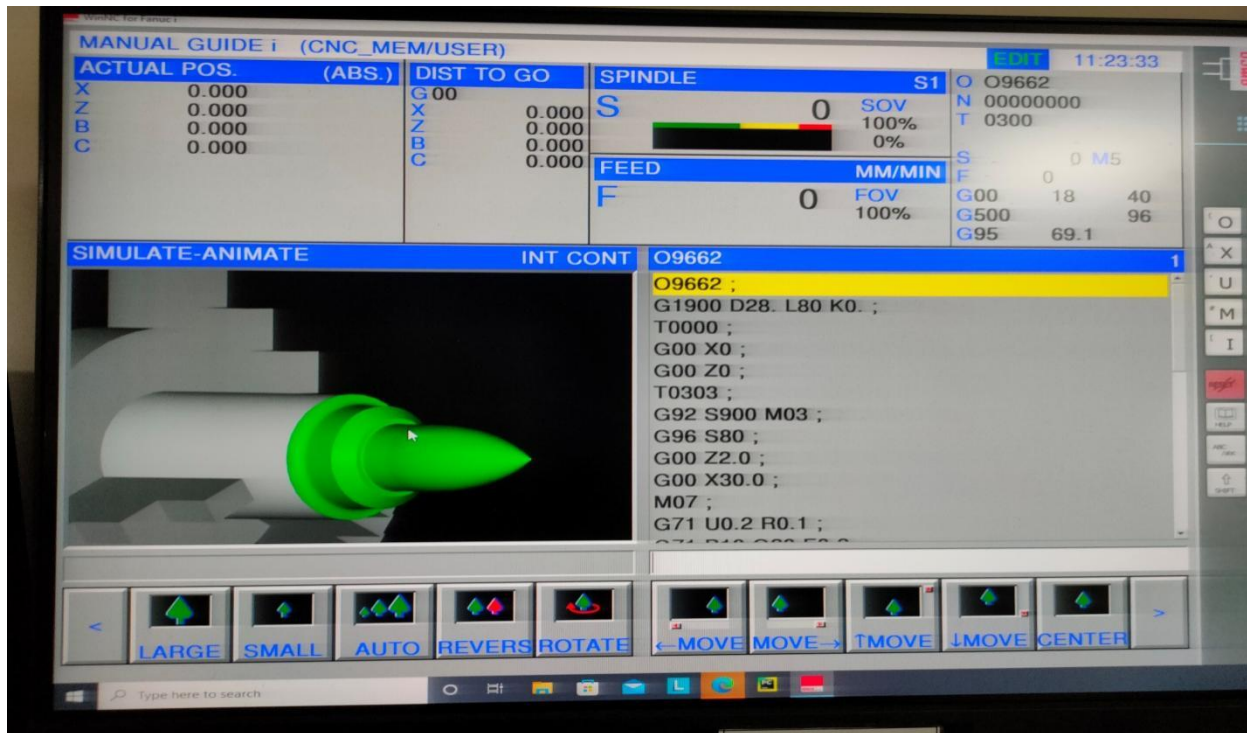
AutoCAD is a commercial computer-aided design (CAD) and drafting software application. Developed and marketed by Autodesk.

- The given component is designed in Autocad of defined dimensions and two dimensional drafting is done.
- The two dimensional drafting is revolved using revolve feature (360 degrees) in 3D modelling.
- Finally the Basic layout model is prepared of given dimensions in order to manufacture the given component on CNC Lathe machine using G-codes& M-codes.

SIMULATION:

EMCO LAUNCH SOFTWARE-

The given component is initially simulated in EMCO LAUNCH software so that the program can be directly entered on the controller of CNC machine and machining operation can be performed automatically according to the program (input) and the output is obtained after the program ends and cycle stops.



SYNTAX OF PROGRAM:

```

O9662;          - Program number
T0000;
G00 X0;
G00 Z0;
T0303;          - Tool station Number & Offset number
G92 S900 M03;  } Spindle On
G96 S80;       }
G00 Z2.0;     } Safety Position
G00 X30.0;    }
M07;          - Coolant On
G71 U0.2 R0.1; }
G71 P10 Q20 F0.2; } Parameter Line
N10 G01 X0.0;
G01 Z0.0;
G03 X15.0 Z-25.0 R20.0;
    
```



G01 Z-30.0;
 G01 X17.0;
 G01 X23.0 Z-33.0;
 G01 Z-38.5;
 G02 X26.0 Z40.0 R1.5;
 N20 G01 X30.0;
 G00 Z2.0;
 M05; - Spindle Stop
 M09; - Coolant off
 G97 T0000;
 G00 X0; } Homing
 G00 Z0;
 M30; - End of program and return to start

MODEL CALCULATION:

$$\text{SPINDLE SPEED(N)} = V * 1000 / \pi * D$$

$$= 80 * 1000 / 3.14 * 28 = 900\text{rpm}$$

Where,

V= Cutting speed.

D= Diameter of the work piece.

N= Spindle speed in RPM.

For Carbide tool and mild steel work piece cutting speed is given as 80 m/min.

CO-ORDINATES OF GIVEN COMPONENT :

<u>POINT</u>	<u>G-CODES</u>	<u>X</u>	<u>Z</u>	<u>R-RADIUS</u>
1.	G01	0.0	0.0	-
2.	G03	15.0	-25.0	20.0
3.	G01	15.0	-30.0	-
4.	G01	17.0	-30.0	-
5.	G01	23.0	-33.0	-
6.	G01	23.0	-38.5	-
7.	G02	26.0	-40.0	1.5
8.	G01	30.0	-40.0	-

Where,

G00- Rapid Positioning

G01- Linear Interpolation

G02- Circular Interpolation (CW)

G03- Circular Interpolation(CCW)

G71- Rough Turning cycle

P10 - Starting block

Q20 - Ending block

R 0.2 - Retraction

W0.2 - Incremental depth of cut

F0.2 - Feed Rate

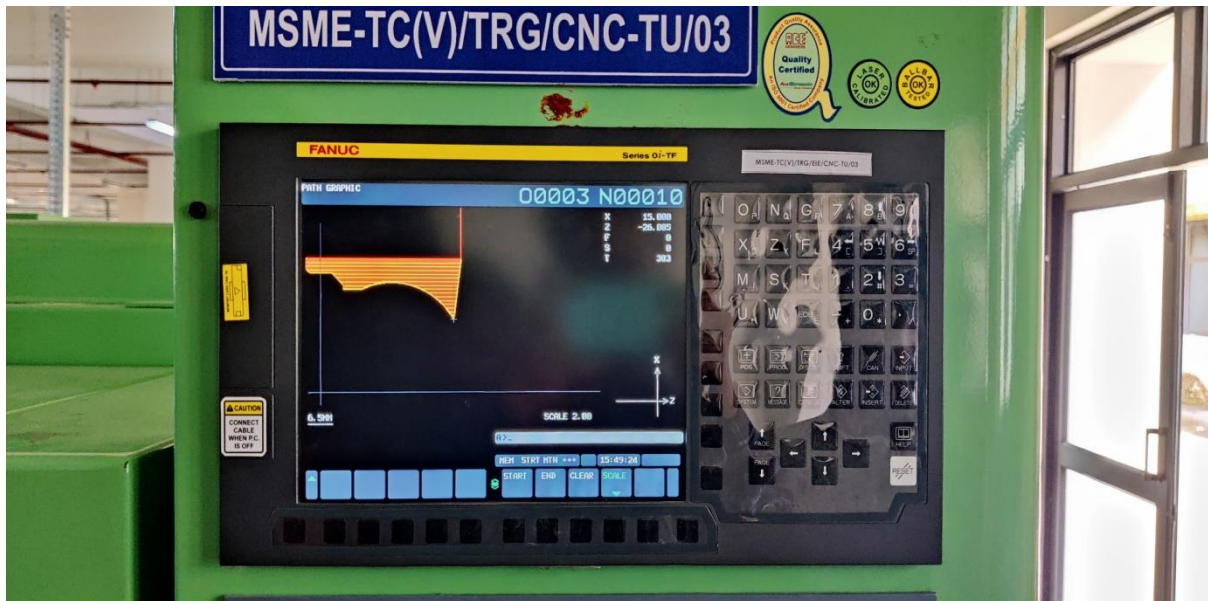
G92 - Spindle Speed Limit

CNC LATHE MACHINE (FANUC CONTROLLER):

The operations performed on the lathe machine are facing, turning, step turning, chamfer, fillet, taper and surface finish operations are performed on CNC machine using Alpha-Numeric codes(G-codes& M-codes).Therefore, CNC program for the required operations are prepared as mentioned in the syntax of part program.



DRY RUN TEST :



MANUFACTURING ON CNC LATHE MACHINE:





CONCLUSION:

Therefore the component given is designed in AUTOCAD, simulation is done in EMCO LAUNCH, DRY RUN test is performed on CNC lathe machine & Manufactured on CNC lathe machine according to the given geometry (i.e., shape, size & dimensions)

RESULT:

Hence the given component is manufactured according to the given dimensions using CNC program(G-codes& M-codes) and the accuracy of the given component is improved.

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