CAM (Surf Cam)

• Instructor - Robert Tosch Ext. 7421

• Course Objectives
  – Bolt circle on clock
    • work on parts for clock
  – Use CAM software to create a CNC program for a name plate
  – CNC name plate

• Lunch
  – Finish mill & drill clock
    • CNC mill/engrave face
  – Assemble clock
Bolt circles
• Bolt circle are common on flanged parts
  – Trig can be very useful in finding the hole locations
Type “A” bolt circles

- Note origin for dimensions
- Determine the X, Y value for hole #5 for a 9 hole pattern on a 5” bolt circle
  
  - X = 0.32899
  
  - Y = 0.96985
Type “B” bolt circles
• Note origin for dimensions – central coordinates
  – Determine the X, Y value for hole #7 for a 18 hole pattern on a 6” bolt circle
  – X =
  – Y =

<table>
<thead>
<tr>
<th>17 Holes</th>
<th>18 Holes</th>
<th>19 Holes</th>
</tr>
</thead>
<tbody>
<tr>
<td>x1</td>
<td>-0.09187</td>
<td>x1</td>
</tr>
<tr>
<td>y1</td>
<td>-0.49149</td>
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<tr>
<td>x2</td>
<td>-0.26322</td>
<td>x2</td>
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<tr>
<td>y2</td>
<td>-0.42511</td>
<td>y2</td>
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<tr>
<td>x3</td>
<td>-0.39901</td>
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<tr>
<td>y3</td>
<td>-0.30132</td>
<td>y3</td>
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<tr>
<td>x4</td>
<td>-0.48091</td>
<td>x4</td>
</tr>
<tr>
<td>y4</td>
<td>-0.13683</td>
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<tr>
<td>x5</td>
<td>-0.49787</td>
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<td>+0.04613</td>
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<tr>
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<td>-0.44758</td>
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<tr>
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<td>+0.22287</td>
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<tr>
<td>x7</td>
<td>-0.33685</td>
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<td>y7</td>
</tr>
<tr>
<td>x8</td>
<td>-0.18062</td>
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<tr>
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<td>y8</td>
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<tr>
<td>x9</td>
<td>0.00000</td>
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<tr>
<td>y9</td>
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<tr>
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<tr>
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</tr>
<tr>
<td>y11</td>
<td>+0.36950</td>
<td>y11</td>
</tr>
</tbody>
</table>
Topaz bolt circle

• Read the manual
  – Bolt Hole Circle” mode
  – LED shows the letter “C” for center.
  – Press [ > ] to move to the next input.

• Follow the LED directions
Base Plate

- Datum callouts
- Hole callouts
- GD&T – Geometric Dimensioning & Tolerancing
Clock Face

12 x 1/4-20 UNC - 2B
L: Ø0.38 × 0.25
±0.014

Stamp initials this end

Ø0.31 THRU
±0.014

2 x Ø0.21 × 1.25
1/4-28 UNF - 2B × 1.00
±0.010
CAM - SURFCAM

• Why is CAM valuable
  – As compared to manual programming

• CAD/CAM Boosts productivity
  – Speeds up CNC programming – by allowing
    the programmer to automatically generate the
    NC program from the engineering CAD data
  – Reduces machine set up time – reduces the
    program prove out time
  – Especially critical where lot sizes are small
    and/or parts are complex
Learning any CAM Software

• (6) processes for all CAM Systems

• Job Setup
  – Axis selection, Retract (safety) Plane, Stock, Work holding, Machine Specific equipment

• Geometry selection
  – Geometry to machine, offsets Geometry, containment boundaries

• Tool selection
  – Tool definition, flutes, material, chip load & cutting speed
Learning any CAM Software - Continued

• (6) processes for all CAM Systems
• Machining Strategy
  – Cut direction, tolerances, radial cut, axial cut, High Speed Machining options
• Speeds & Feeds
  – Approach feed, Machining Feed, Retract feed, slow down feed, Spindle Speeds
• Approach & Retract into & out of Cuts
• $$$ Cycle time reduction
SURFCAM Screen layout

• Help screen
  – Contents
  – Store to T drive – Backup to Thumb drive

• Save early & often

• Hot keys increase your productivity
  – Underline = hot key
  – Display the Tap / Drill Chart. Press CTRL+T
Layers & Colors

• Layers
  – Create geometry on different layers

• Color
  – Select color when creating geometry
Getting started

- Cartesian coordinate system
- Origin Point – X0Y0
- Create Geometry
  - Points
  - Lines
  - Circles
- Fillet & Chamfer
- Right & Left mouse buttons
  - Center roller
Screen icons

• New, Open & save
• Delete
• Transform
  – Copy
  – Move
• Operations manager
Point Geometry

- Selection options – determines how geometry is located
  - Sketch = danger not accurate
  - End point = end point of existing geometry
  - Center = select arc geometry to find center
  - Keyboard = Enter X, Y, and Z coordinates
  - Quadrant = select quadrant of circle
Line Geometry

• Selection options
  – Tangent = tangent to an arc
  – Horizontal = horizontal line
  – Vertical = vertical line
  – Angle = create line at an angle
  – Offset = offset for a line (awesome feature)
  – Rectangle = create a box
Circle Geometry

• Selection options
  – Center/Radius
  – Center/Diameter
  – Create > fillet = create fillet between geometry

• Create geometry using keyboard entry & existing geometry
**Keyboard Input**

- Create line
  - End points > keyboard
- 6.00 x -2.00 dimensions
  - create a box

![Construction View](image)

**X₀, Y₀**

2.00”

6.00”
Edit color & Change layers

• Create Dimensions
  – Leader dimensions
Edit > Trim/Break

• Trimming One Entity
  – digitize entity to keep (area to keep)
  – digitize the trim too entity

• Trimming Two Entities

• Radius trim

• Breaking an Entity
  – digitize the first entity
  – digitize the entity to break too.

• Be aware of where you select the element
Create box

- Create a 2 x 6 rectangle
- Save file to thumb drive
Create text

- Font type: True type
- Font: Stencil
- Text height size to fit 2 x 6 rectangle
Explode text

- Edit Text & explode
Add cutter path

- Load cutter & change to tool #1
- Change feed rates to 10.0
- Change cutting method to on geometry
- Select geometry, depth .010 & press OK
Generate CNC code

- Open operations manager
- Select post icon
Select Post & generate code

- Select machine: Haas VF series
- Verify F words (feed to 10.)
- Save code to thumb drive
Clock Face bolt circle
Assignment

• Split in 2 groups
  – Continue milling/drilling for clock
    • Assemble clock
  – CNC mill name plate

1) Create part outline & add text
text will be of suitable size to fit material
2) Explode text & add cutter path
3) Generate CNC code & save to thumb drive
4) Load program in CNC machine, Zero tool
5) CNC Engrave Name plate
ACC Grant Information

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