CAM Based CNC Multi-Axis Programming Using NX 11
Course: DMT -089A-61
Time: 5:30PM - 9:50PM, Mon / Wed

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Syllabus

Note: This is a CAM class with demonstration. General knowledge of machine practices are expected. This class will not focus on, part material, cutter geometry, or speeds/feeds and cutter motion requirements of specific materials being cut. In other words, this is about how to use a hammer, not how to build a house.

Required materials

- There is no book for this class (NX CAM), however a CAD book for NX11 is available through Amazon “Siemens NX 11 Design Fundamentals” and on the CADCIM page below. There are also a number of books for NX CAD on Amazon you may consider.
- $53 @ the DeAnza online store on NX CAD: [http://www.cadcim.com/cadcambooks.aspx?ShortName=NX](http://www.cadcim.com/cadcambooks.aspx?ShortName=NX)
- Siemens does have an online CAD&CAM course called “Learning Advantage”. Once you have an account you can access this from anywhere. Put a request in with Max Gilleland: gillelandmax@fhda.edu, mention you are enrolled in this class and ask for a Learning Advantage account. You will receive an email to activate your session.
- A memory stick is highly suggested. All material will be in a PDF, AVI, or other electronic format.
NX 11 CAM Class Objectives

• 2.5 Axis Milling
• 3 Axis Milling
• 5 Axis Milling
• Drilling, Tapping, Thread Milling
• Assemblies, some Geometry creation related to Manufacturing
• Cutter creation, speeds & feeds, Verification, Posting
<table>
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<th>What we will cover</th>
<th>CAD</th>
<th>CAM</th>
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<tr>
<td></td>
<td>UI, CAD over view</td>
<td>Operation Navigator; Views</td>
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<td></td>
<td>Roles</td>
<td>Cutters (Milling, Drilling, Tapping)</td>
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<td>CSYS (2) (Coordinate Systems)</td>
<td>MCS (Manufacturing CSYS)</td>
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<td>Analysis (measuring the part)</td>
<td>Geometry (Part, Boundaries, Stock, Check)</td>
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<td>Curve Creation</td>
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<td>Move Objects</td>
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<td>Ruled Surface</td>
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<td>Sweep along guide,…</td>
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<td>Wave Link (assembly part copy)</td>
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<td>Synchronous Modeling</td>
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**Grading**

- The student's progress is evaluated objectively on the basis of scores from examinations and class work, covering laboratory work.
- Two major examinations are given. These examinations constitute approximately 50% of the final grade.
- Class work constitutes the other 50% of your grade.
- Assignments turned in late will receive max 50% of the points (credit).

**GRADE DISTRIBUTION:**

- A = 90% to 100%
- B = 80% to 89.9%
- C = 70% to 79.9%
- D = 60% to 69.9%
- F = 59.9% or less
• Class work, 12-15 parts over the quarter which will be 50% of your grade.
  • 100 points per part, points distributed amongst:
    • Using Operations types requested
    • Stock & Assembly creation
    • Tool creation, Program groups, Geometry groups
    • Cutting parameters, Stock, Tolerance, Feeds & Speeds, Engage & Retracts,
      User Defined Events (like coolant on/off), Axial & Radial stepover, etc.
  • Lowest graded part will be dropped

• Two Tests (mid term & final) 25%/each, for 50% of your grade.
  • Tests are parts, like the class work. Do your best to understand the class work, you
    will do well on the tests. 100 points to be earned for each test.

• Final will be Monday, March 26th

• Extra credit

Ask Questions! Take Notes!
Siemens NX student software options:
Important information about getting NX software for Winter 2018.
• If you choose to purchase a copy of NX for personal training (Student Edition) and do class projects at home, a student license is available. This is optional and not required. It will allow you to use the software from home.

Please note two important things about getting this software:
1. The process can take up to two weeks to complete.
2. Siemens only allows the purchasing of this software if you are currently enrolled in a Siemens NX class.
The best way to prove this is to print out or digitally capture your current schedule and a student ID card to mail or FAX that information to the companies selling the product on behalf of Siemens; typically Studica. Once through the process, you should receive an email directly from Siemens about obtaining your purchase. Carefully read all specifications and information.

www.studica.com/nx-learning-edition.html more information also at http://www.deanza.edu/dmt/software_download_info.html#Siemens_NX

Some related basic info.
• Be mindful of the “Specifications” for the software! I would recommend a minimum 8GB of RAM, and processor speeds over 2.4 Ghz and a good graphics card. See the Studica page for more information.

If you are enrolled you will shortly be provided with access to Siemens Learning Advantage for the duration of the class but you must email GillelandMax@DeAnza.edu to get that access. It is not required and there is no cost to you for access.
More info on Siemens Learning Advantage can be found here:
A 2 year Adv Gold Membership is available: www.journeyed.com/item/Siemens/Learning+Advantage/1558225
A Free online Siemens Learning Advantage account available is available to all enrolled student.
**NX11 Learning Edition now available to order.** This can take 2 weeks so order it ASAP. Only available to students that can prove they are taking a NX Class. Note hardware needs. [http://www.studica.com/nx-learning-edition.html](http://www.studica.com/nx-learning-edition.html)
If you request access to the DMT Dept. account to Siemens online Learning Advantage Academic accesses your account will last the duration of the class. If you want access longer you will need to purchase a membership from JourneyED.

Academic Membership Purchase Process Institutions:
Academic Gold Memberships are available for institutions that are active GO PLM academic partners. For more information on how to redeem these memberships, see the Academic Membership Frequently Asked Questions.
Individuals
Individual Academic Gold Memberships are available to students and faculty at eligible institutions. These memberships are only sold through our online vendor: JourneyED

Learning Advantage, a convenient easy-to-use e-learning portal, offers an Academic Membership to educators and students who need to gain skills and knowledge of Siemens PLM Software solutions through a library of more than 1,000 NX, Teamcenter and Tecnomatix self-paced courses and assessments for less than the price of a textbook.
The self-paced courses are designed to run side-by-side with Siemens PLM Software products (software products are sold and licensed separately). The membership period is 2 years from date of activation.
Please consider signing up for “ANY” CDI 101-110 CAD Labs so you can access all the resources.

You will need to email Max Gilleland and ask for an ADD CODE to be able to get in the Labs up to the last add date of 1/20/2018. After this date you not be able to add a lab class.
email: CAD@DeAnza.edu
CAD LAB LOCATION E35

When you sign up for any CAD Labs, you can get access whenever they are open.
*A CAD Lab normally means any CDI 101 through 110 section.

Normal CAD Lab hours for Winter 2018 will be:
-Monday & Wednesday 9am to 7:20pm
-Tuesday & Thursday 9am to 6:00pm

Winter CAD & Manufacturing/CNC classes begin Monday Jan. 8th, 2018
http://www.deanza.edu/schedule/classes/schsearch.html
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<td>Multi axis machining / multiple set up, mach simulation 1</td>
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<td><strong>FINAL EXAM</strong></td>
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Some NX History

1963 - United Computing created an APT programming language called UniAPT. Released in 1969, it was one of the world's first end-user CAM products.

1973 - United Computing bought CAD source called (ADAM) from MCS, to not only add CAD, but a graphical interface to UniAPT.

1976 - McDonnell Douglas bought United Computing. MDC finished the CAD/CAM merger, calling it UniGraphics. They made UniGraphics a commercial product in 1975. Later the name was shortened to UGS (UniGraphics Solutions). MDC purchased Shape Data, whose product, ROMULUS was later renamed to ParaSolid.

1991 - EDS purchased UGS from MDC. They then purchased SDRC in 2001. The merged product was renamed NX, though the company was still UGS. (UG went from V1-19, NX is V20 and beyond)

2004 - EDS sold UGS to private equity company. They still operated under the name UGS.

2005 - UGS purchased Technomatics. Their product was called Valisys, an inspection and tolerance analysis tool.

2007 - Siemens bought UGS. They changed the name to Siemens PLM from UGS. The product retained its NX name.
Operation Types

- **Type**: mill_planar
- **Type**: mill_multi-axis
- **Type**: mill_contour
- **Type**: mill_rotary
- **Type**: hole_making
- **Type**: turning
- **Type**: wire_edm
Operation Types

- mill_planar
- mill_multi-axis
- mill_contour
- mill_multi_blade
- mill_rotary
- hole_making
- turning
- wire_edm
Operation Types

- **floor_and_wall**
  - Cuts floors and walls.
  - Select floor and/or wall geometry. The material to be removed is determined by the cut area floor and the blank thickness.
  - Recommended for basic face milling of planar faces on prismatic parts. This operation replaces the FACE_MILLING_AREA operation found in previous releases.

- **hole_making**

- **mill_planar**

- **mill_multi-axis**

- **mill_contour**

- **mill_rotary**

- **wire_edm**
Planar Mill
Removes material in planar cut levels normal to a fixed tool axis.

Define part boundaries parallel to the floor. Part boundaries determine critical cut levels. Select blank boundaries. Select the floor to define the bottom cut level.

Recommended for general use in roughing out large volumes of material on prismatic parts with vertical walls.
Operation Types

- **Planar Profile**: Uses the Profile cut pattern to produce single pass, multiple level planar tool paths that profile along part boundaries. Define part boundaries parallel to the floor. Select the floor to define the bottom cut level. You may use a user defined milling tool with tracking points. Recommended for following planar walls or edges.

- **Mill Planar**: Operation subtype for planar milling.
- **Mill Multi-Axis**: Operation subtype for multi-axis milling.
- **Mill Contour**: Operation subtype for contour milling.
- **Mill Rotary**: Operation subtype for rotary milling.
- **Wire EDM**: Operation subtype for EDM wire cutting.
Operation Types

Cavity Mill
Roughs a contoured shape by removing material in planar cut levels normal to a fixed tool axis.
Part and blank geometry must be defined.
Recommended for removing large volumes of material on mold cavities and cores, dies, castings, and forgings.
Corner Rough

Uses Cavity Mill to rough out material remaining in corners that a previous tool could not reach.

Part and blank geometry must be defined. Specify a tool used in a previous roughing operation as the Reference Tool to determine the cut regions.

Recommended for roughing out material that a previous tool could not reach due to its diameter and corner radius.
Operation Types

Type: mill_planar

Type: mill_multi-axis

Type: mill_contour

Type: mill_rotary

Type: hole_making

Type: turning

Type: wire_edm

Zlevel Profile

Uses planar cuts normal to the tool axis to profile walls at specified levels. Can also clean up material left in gaps between levels.

Specify part geometry. Specify the cut area to determine the faces to profile. Specify the cut levels to determine the distance between profile passes.

Recommended for semi-finishing and finishing contoured shapes such as molds, dies, castings, and forgings.
Operation Types

- **mill_planar**

- **mill_multi-axis**

- **mill_contour**

- **mill_rotary**

- **hole_making**

**Fixed Contour**

Basic Fixed Axis Surface Contouring operation used to contour the part or cut area with various drive methods, containment, and cut patterns.

Specify part geometry and cut area if necessary. Select and edit the drive method to specify drive geometry and cut pattern.

Recommended for general use in finishing contoured shapes.
Operation Types

Variable Contour
Basic variable axis surface contouring used to contour the part or cut area with various drive methods, containment, cut patterns, and tool axes.

Specify part geometry. Specify drive method. Specify the appropriate variable tool axis.

Recommended for general use in variable axis finishing of contoured surfaces.
Operation Types, we might not cover this operation type in our class

- **Type**: mill_planar
- **Operation Subtype**: [Diagram]

- **Type**: mill_multi-axis
- **Operation Subtype**: [Diagram]

- **Type**: mill_contour
- **Operation Subtype**: [Diagram]

- **Type**: mill_rotary
- **Operation Subtype**: [Diagram]

- **Type**: hole_making
- **Operation Subtype**: [Diagram]

- **Type**: turning
- **Operation Subtype**: [Diagram]

- **Type**: wire_edm
- **Operation Subtype**: [Diagram]

**Rotary Floor**

Multi-axis operation that finishes floors of cylindrical parts.

Part geometry is defined in the WORKPIECE geometry parent. Specify floor, walls, and the part rotary axis in the ROTARY_GEOM geometry parent. Edit the drive method to specify the cut pattern.

Recommended for finishing floors on a cylindrical part.
Operation Types

Counter Sinking
Drilling operation that can manually countersink selected geometry or use recognized features grouped based on the feature type.

Select hole geometry or use recognized hole features. In-process feature volume determines material to be removed.

Recommended method for drilling individually selected holes or holes within a hole/boss geometry group or previously recognized features within a feature group.

Tapping
Tapping operation that can manually tap selected hole geometry or use recognized features grouped based on the feature type.

Select hole geometry or use recognized hole features. In-process feature volume determines material to be removed.

Recommended method for tapping individually selected holes or holes within a hole/boss geometry group or previously recognized features within a feature group.

Spot Drilling
Spot drilling operation that can manually spot drill selected hole geometry or use recognized features grouped based on the feature type.

Select hole geometry or use recognized hole features. In-process feature volume determines material to be removed.

Recommended method for spot drilling individually selected holes or holes within a hole/boss geometry group or previously recognized features within a feature group.
Hole Milling
Uses spiral and/or helical cut patterns to machine blind and thru holes.
Select hole geometry or use recognized hole features. In-process feature volume determines material to be removed.
Recommended for machining holes that are too large to drill.

Thread Milling
Machines threads inside holes.
Thread parameters and geometry information may be derived from the geometry, thread features, tool, or specified explicitly. The form and pitch of the tool must match the form and pitch specified in the operation. Select hole geometry or use recognized hole features.
Recommended for cutting threads that are too large for a tap.

Boss Thread Milling
Machines threads on cylindrical bosses.
Thread parameters and geometry information may be derived from the geometry, threaded boss features, tool, or specified explicitly. The form and pitch of the tool must match the form and pitch specified in the operation. Select boss geometry or use recognized boss features.
Recommended for cutting threads that are too large for a die.

Radial Groove Milling
Uses circular pattern to machine radial grooves.
Select radial groove geometry or use recognized radial groove features. In-process feature volume determines material to be removed.
Recommended for machining one or more radial grooves with a T-cutter.
Parts we will work on
Creating Your Student Account

If you are on the wait list you cannot create an account until you add

> student must be an active student in order to create an account <

> waiting list doesn’t count <

De Anza College
Business/CS: Design and Manufacturing Technologies Computer Labs
www.deanza.edu/dmt

1. After the computer is turned on, tap the space bar on the keyboard.
2. Do not insert your USB drive until your account is set and you have a work folder with a Z letter next to it
3. Make sure you have your student ID# ready, and write down the username and password you will create.
4. Enter the word caduser, in “Username” field.
5. Enter hellodmt in "Password" field.
6. Click the arrow to continue or press Enter on the keyboard.
7. Enter all information in proceeding required fields.
8. You will be able to log into your new account in about 5 min.
9. NX11 MUST be launched from the desktop