ENGG2020
FUNDAMENTALS OF EMBEDDED SYSTEM DESIGN

LECTURE 2: PARTS ASSEMBLING

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CONTENTS

- Drawing
  - Sketching
  - Dimensioning
  - Extruded Boss / Extruded Cut
- Parts Assembling
- Rapid Prototyping

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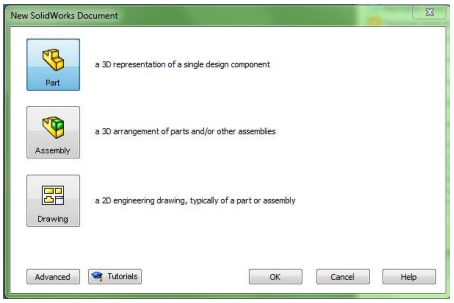
GETTING STARTED

- Run SolidWorks
  - Start > All programs > SolidWorks 2019
- New Document

- Choose "Part" and then "OK" / "Enter"



Create parts (File format: .sldprt)

Assembly parts (File format: .sldasm)

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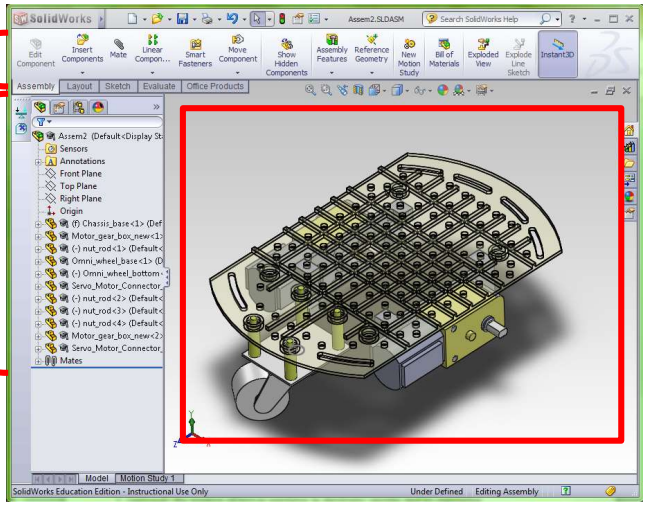
BASIC INTERFACE

Drawing tools

Design tree



Drawing region

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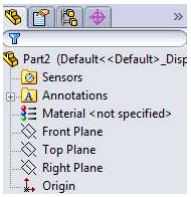
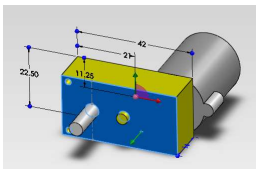
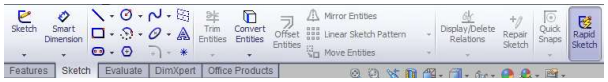
BASIC PROCEDURES ON SKETCHING

- Select plane for sketch
  - Invisible planes, or planer surface on parts





- Create sketch(2-D)



- Draw features on sketch(3-D)

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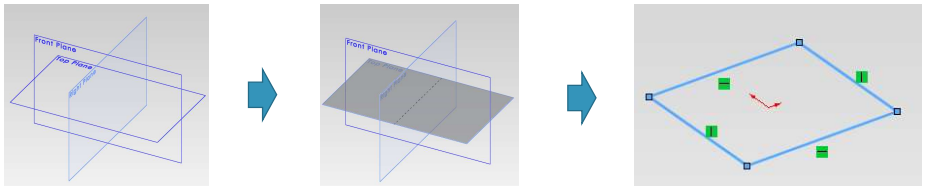
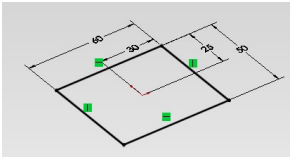
BASIC STEPS



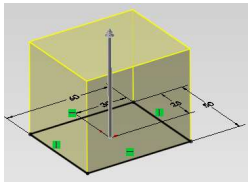
Invisible planes

Select a plane

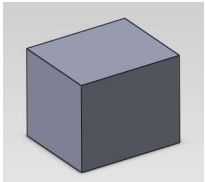
Sketch on the plane



Dimensioning



Create features (extrude)



Finish a feature

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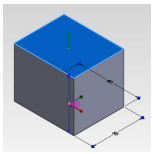
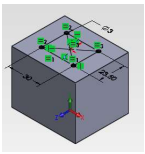
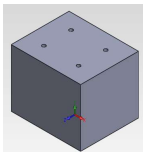
BASIC STEPS



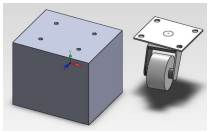
Select other planes



Create more sketches

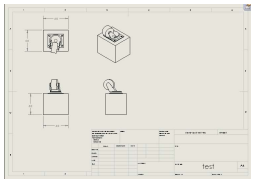


Create more features



Assemble with other parts

Assembly done, or modify if necessary



Create engineering drawing

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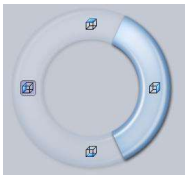
CONTROL

- Standard View - Right click and hold
  - (View > Toolbars > Standard View)

- Shading and background

- Others
  - Rotating – Middle click and hold
  - Panning – Ctrl + Middle click and hold
  - Zooming – Scroll Wheel
  - Fast views – Ctrl + 1,2,3,4,5,6,7



- Many others… we can only cover the basics

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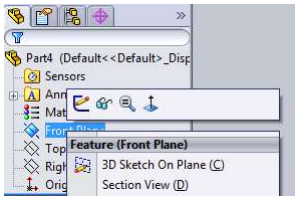
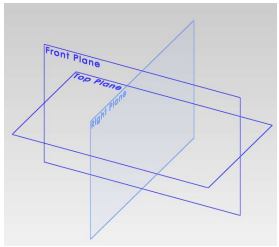
2D SKETCH

- Select a plane and right click.
- In dialog box, click "sketch"
- Or click "sketch" and select a plane





- Exit the sketch before you move on. (at the top of the right side)

Confirm

Discard

Debug: if you stuck somewhere, check this!!

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2D SKETCHING

- Basic sketching
  - Lines
  - Circles
  - Rectangles
  - Arcs
- Modifications
  - Dimensions (many types)
  - Fillets/Chamfers
  - Mirrors
  - Patterns
    - Linear
    - Circular
  - Trims

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2D LINES

- Enter / Create Sketch
- Click line

As sketch: click to define arbitrary first point, second point,…etc

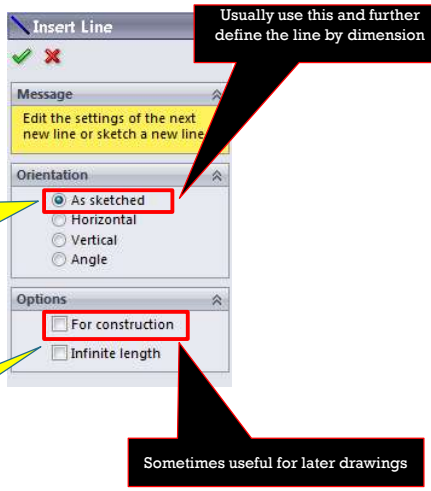
Horizontal: click to draw horizontal line only

Vertical: click to draw vertical line only

Angle: click to draw line by defining angle with respect to horizontal line

For construction: can change the elements for reference

Infinite length: can draw line with infinite length



- ESC : leave the current command
- Delete elements: select the elements and click delete button

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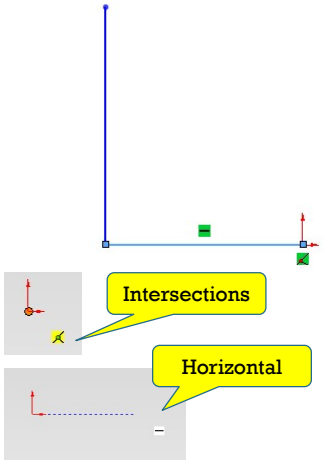
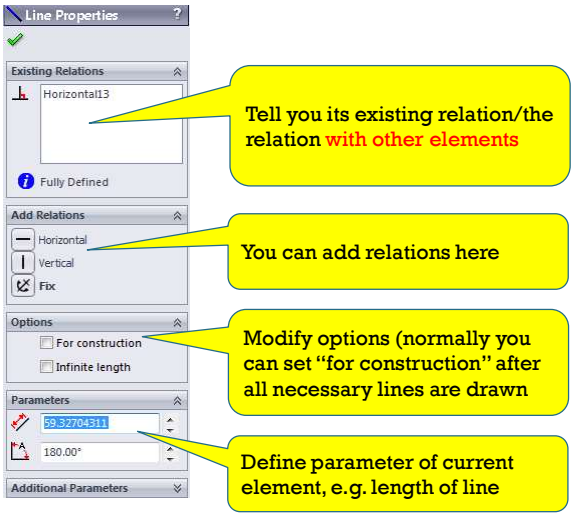
2D LINES





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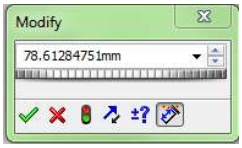
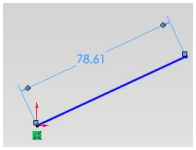
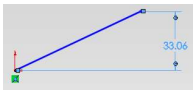
2D LINES DIMENSIONS

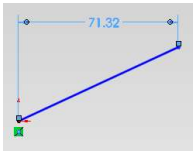
- Click Smart Dimension 

  - Click on the line: define the line by length only
    - Pull the dimension to different directions
      - Along line
      - Vertical
      - Horizontal
    - Then type in the value to modify the line
    - Click 'tick' when done









- Click on 2 points: define the line by 2 end points (similar)

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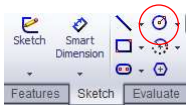
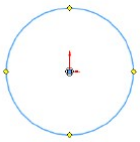
2D CIRCLES

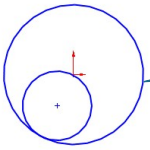


- Select Circle 
  - Click a point(center), then click another point(radius)



Radius and Center

- Select Perimeter Circle 
  - Select three points to define a circle



Useful when you want to draw tangent circle

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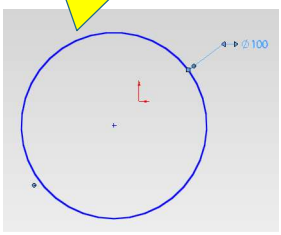
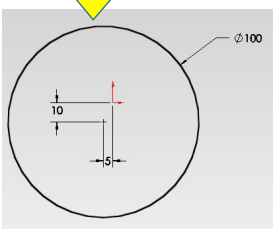
2D CIRCLE DIMENSIONS

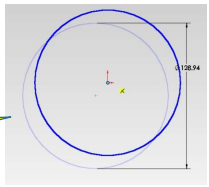
- Usually it is defined by its center and radius

Not yet fully defined (**Blue**)



Fully defined (**Black**)





Or use the mouse to force the relations of the center with some reference (e.g. the origin)

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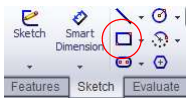
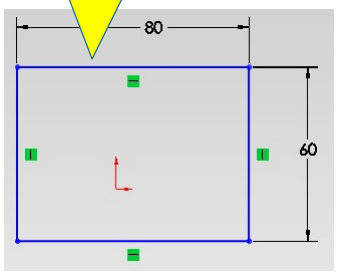
2D RECTANGLES

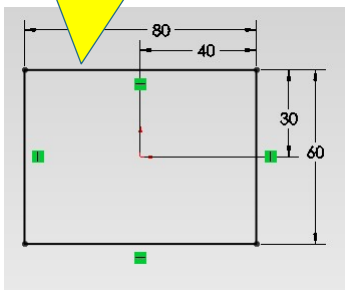


- Select rectangle
  - Click 2 points to define it
- Usually it is defined by 2 sides

Not yet fully defined (**Blue**)



Fully defined (**Black**)



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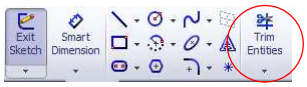
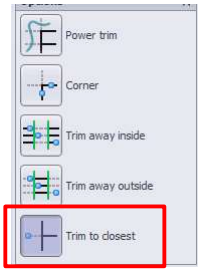
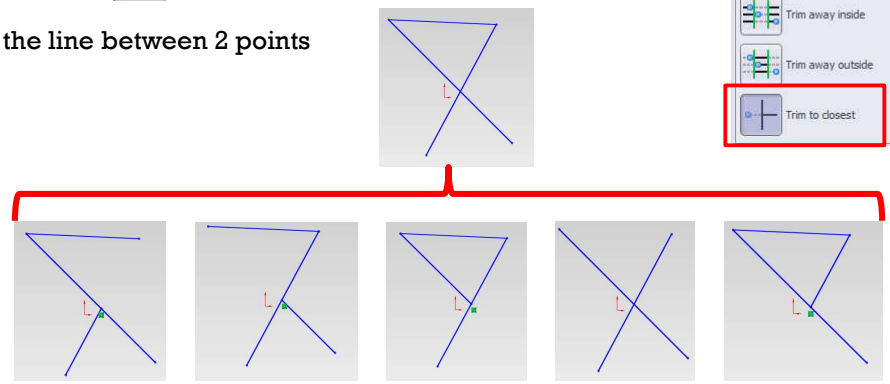
2D TRIM (CUTTING LINES)



- Click trim  and select "trim to closest"



- Trim the line between 2 points



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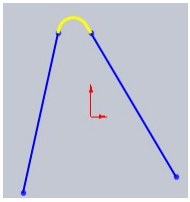
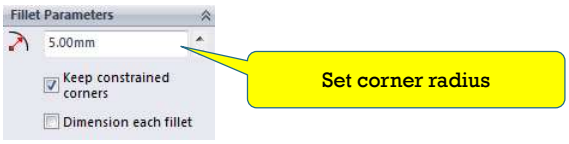
2D FILLETS

- Click fillet 

- Fillet the corner at the intersection of two sketch (choose a corner)





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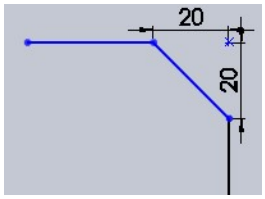
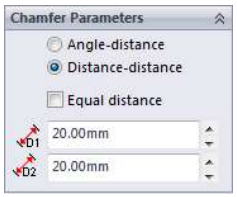
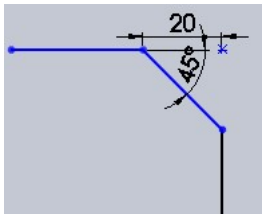
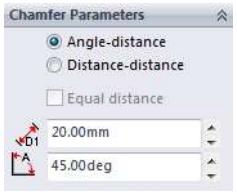
2D CHAMFERS

- Click Chamfer 









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3D

- Extrude / extrude cut
- Revolve / revolve cut
- Fillets / chamfers
- Mirror
- Patterns
  - Linear
  - Circular
- Many others
  - Loft base
  - Sweep base
  - Etc.

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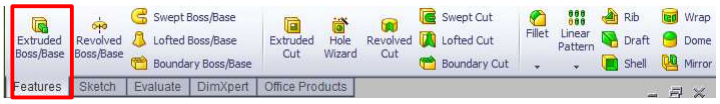
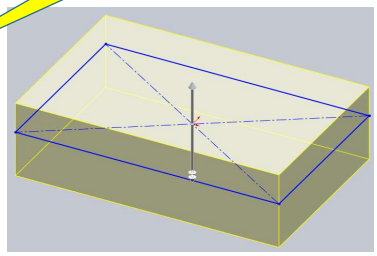
3D EXTRUDES

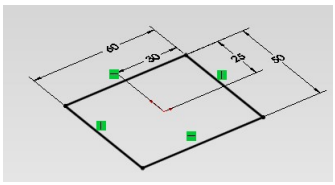


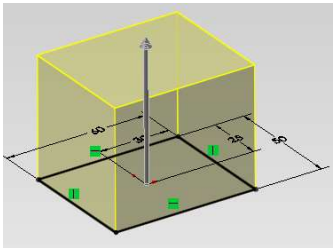
- Select a sketch (must be close-loop)
- Click

Extrude type

Extrude thickness







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3D EXTRUDES

Frequently used

Blind	Set the Depth
Through all	Extends the feature from the sketch plane through all existing geometry.
Up to Vertex	Select a vertex in the graphics area for Vertex
Up to Surface	Select a face or plane to extend to in the graphics area for Face/Plane . Double-click a surface to change the End Condition to Up to Surface, with the selected surface as the termination surface. If the sketch that you extrude extends outside of the selected face or surface body, Up To Surface can do some automatic extension of one analytic face to terminate the extrusion.
Offset from surface	Select a face or plane in the graphics area for Face/Plane , and enter the Offset Distance . Select Translate surface to make the end of the extrusion a translation of the reference surface, rather than a true offset. If necessary, select Reverse offset to offset in the opposite direction.
Up to body	Select the body to extrude to in the graphics area for Solid/Surface Body . You can use Up To Body when making extrusions in an assembly to extend the sketch up to the selected body. Up To Body is also useful with mold parts, if the body you extrude to has an uneven surface.
Mid plane	Set the Depth

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RAPID PROTOTYPING

- Flows of Rapid Prototyping (RP)
  - Design some parts
  - Save as .STL format
  - Send to a 3D printer for printing or fabrication
  - Post-treatment such as supporting materials removal
- Demonstration of the RP process:
  - http://www.youtube.com/watch?feature=player_embedded&v=bpcwBQKUqK4

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ANY QUESTIONS ?

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