

# COMPUTER AIDED ENGINEERING DESIGN (BFF2612)

## PART DESIGN Sketch Based Features

by

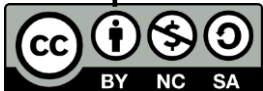
Dr. Mohd Nizar Mhd Razali  
Faculty of Manufacturing Engineering  
[mnizar@ump.edu.my](mailto:mnizar@ump.edu.my)



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Design: Dr Nizar

# MODELLING STRATEGIES

- **Determine model type and subtype.** Is it 2½D or 3D? Within 2½D type, is it extrusion, revolution or composite?
- **Observe geometric characteristics of model.** Is the model symmetric with respect to one plane or more? If so, a designer can construct only half of the model and then use the Mirror command to create the full model.
- **Choose model orientation in 3D space.** Which model face or view is aligned with which view?
- **Choose model origin.** Where is the Model Coordinate System (MCS) origin located on the model sketch?
- **Decide on other geometric details.** Do we need geometric modifiers to speed up construction?
- **Avoid unnecessary calculations.** Can we use the CAD system to perform geometric calculations for us to save time?



# THREE MODELING APPROACHES

## 1. Primitives

Build based on a combination of simple, generic and standard shapes via Boolean operations union, subtraction, and intersection.

## 2. Features

Similar to the primitives approach, replaces primitives with features and embeds Boolean operations in the feature definition.

## 3. Sketching (Commonly use)

Similar to feature approach. Instead of using predefined shapes only, such as holes and ribs, it allows CAD designers to create much elaborate and more general features starting from a sketch.



# THE THREE MODELING APPROACHES: SKETCHING

Select or define a sketch plan



Sketch 2D profile



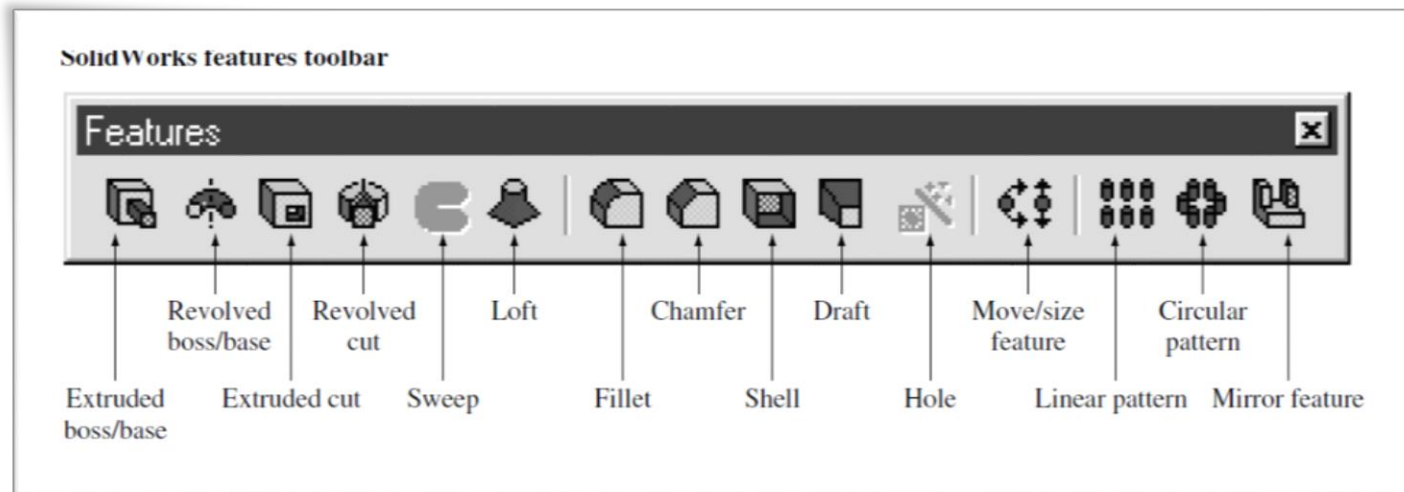
Modify the feature



Create the feature



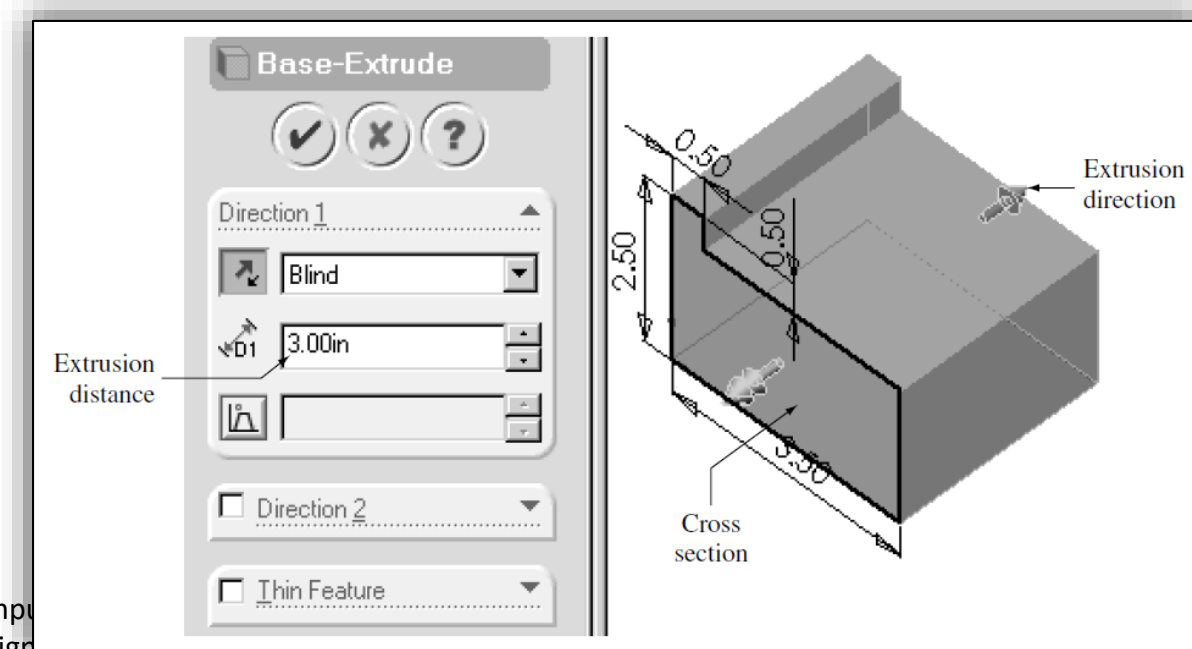
# BASIC FEATURES FOR 3D MODEL



# BASIC FEATURES FOR 3D MODEL

## EXTRUSION

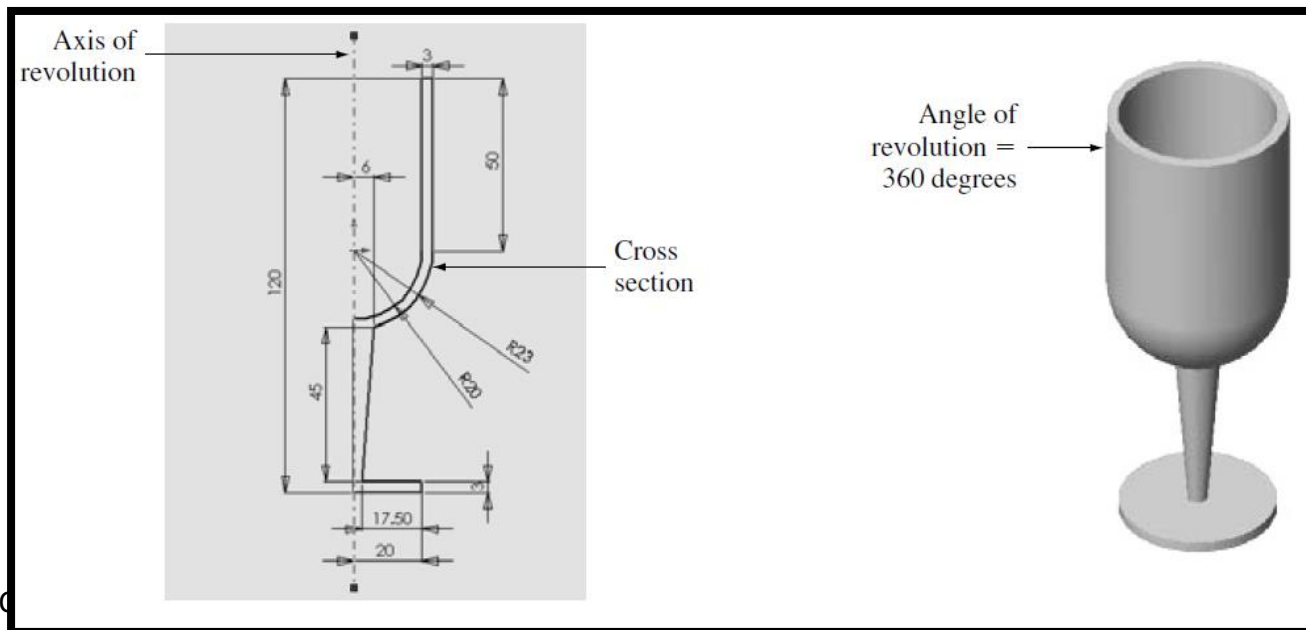
- Create a uniform-thickness model.
- Requires a cross section and extrusion vector (direction and a distance).



# BASIC FEATURES FOR 3D MODEL

## REVOLUTION

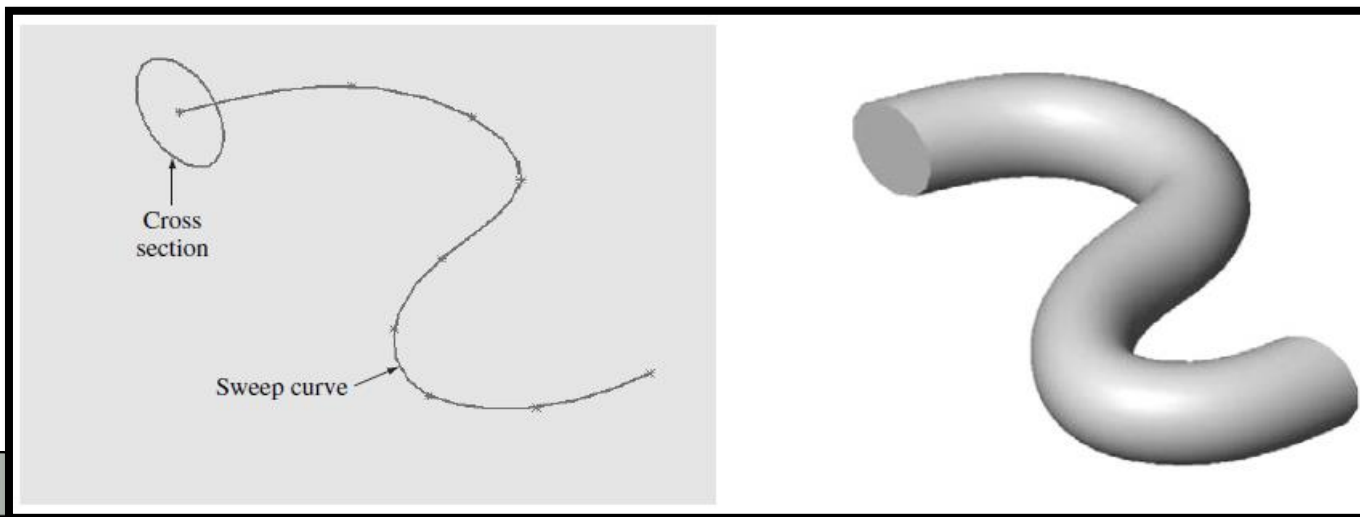
- Create axisymmetric models.
- Requires a cross section, an axis of revolution and an angle of revolutions.



# BASIC FEATURES FOR 3D MODEL

## **SWEEP**

- Create a model with a constant cross section along a nonlinear axis (generalization of the extrusion feature).
- Requires a cross section and a sweep curve.
- If the sweep curve is linear, the sweep becomes an extrusion.

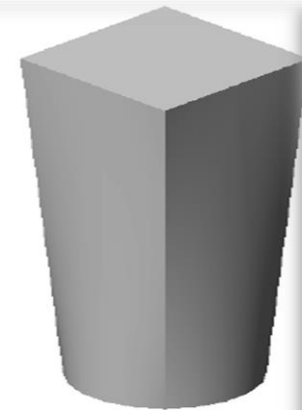
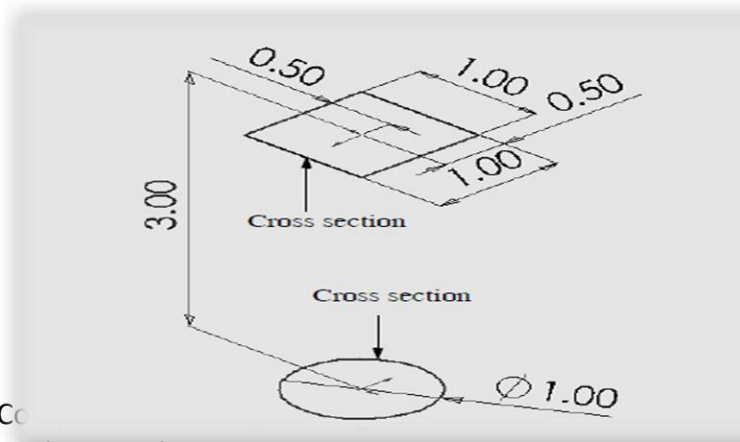




# BASIC FEATURES FOR 3D MODEL

## LOFT

- Create a model with a variant cross section along a linear/nonlinear axis (generalization of the sweep feature).
- Requires a set of cross sections.
- A guide curve may be used to blend the cross sections. If no guide curve is specified a linear blending is assumed.

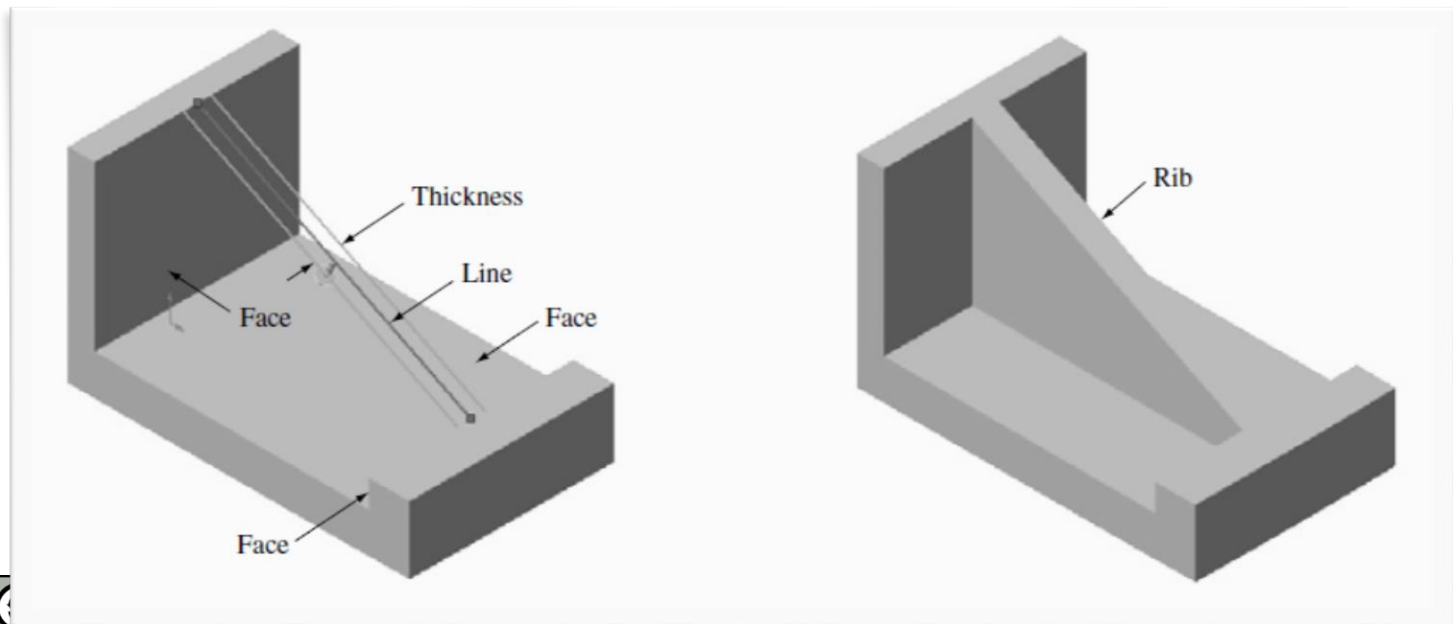


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# BASIC FEATURES FOR 3D MODEL

## RIB

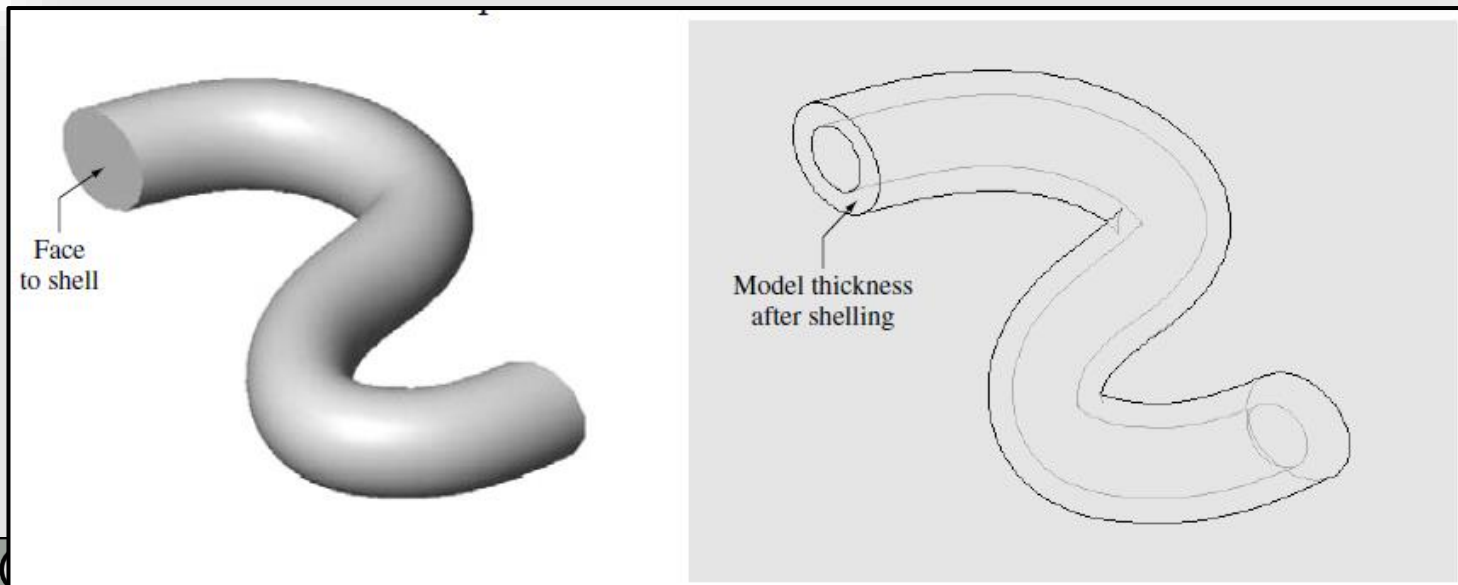
- As a stiffener for models.
- Requires a line, the faces to stiffen and a thickness.



# BASIC FEATURES FOR 3D MODEL

## SHELL

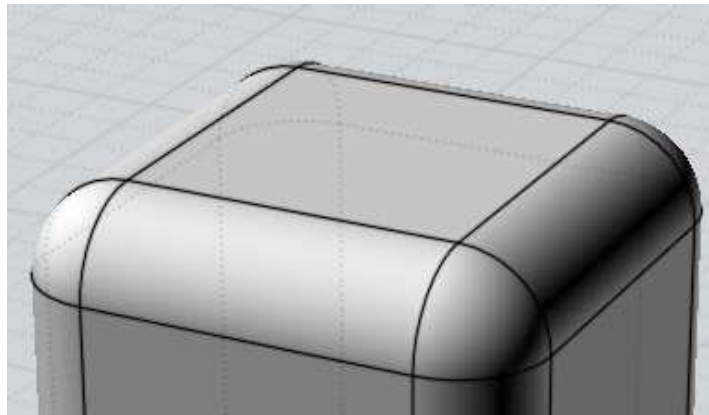
- To carve out material from a model by “shelling” it.
- Requires a face to shell and thickness to keep.



# BASIC FEATURES FOR 3D MODEL

## **FILLET and CHAMFER**

- To change the corners of a model.
- Fillet uses to eliminate sharpness, reduces the stresses around the corners.
- Chamfer creates a transition between two edges of a model.



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# BASIC FEATURES FOR 3D MODEL

## **DRAFT**

- To create a slant (taper) in model faces (for models of injection molds).
- Requires a draft angle (usually a small one between five and ten degrees) and the faces to draft.
- Molds must have drafts to be able to remove the molded parts from the molds.



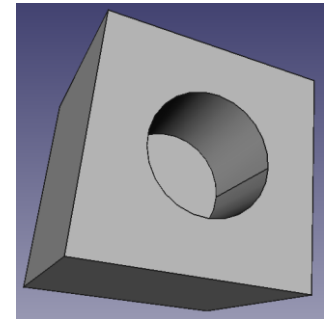
# BASIC FEATURES FOR 3D MODEL

## HOLE

- Requires a hole diameter or radius (size), a length, and an axis to define orientation.

## CUT

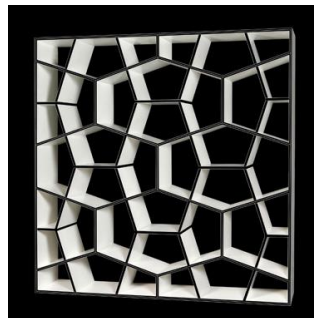
- Cut material from another existing feature.
- Can be made as extruded or revolved cuts.



# BASIC FEATURES FOR 3D MODEL

## **PATTERN**

- A geometric array is used to create repeated geometry in a specific order.
- Linear (rectangular) pattern requires the feature to repeat, the distance between the repetitions, and the number of repetitions.
- Circular pattern requires the feature to repeat, an angle between the repetitions, and the number of repetitions.

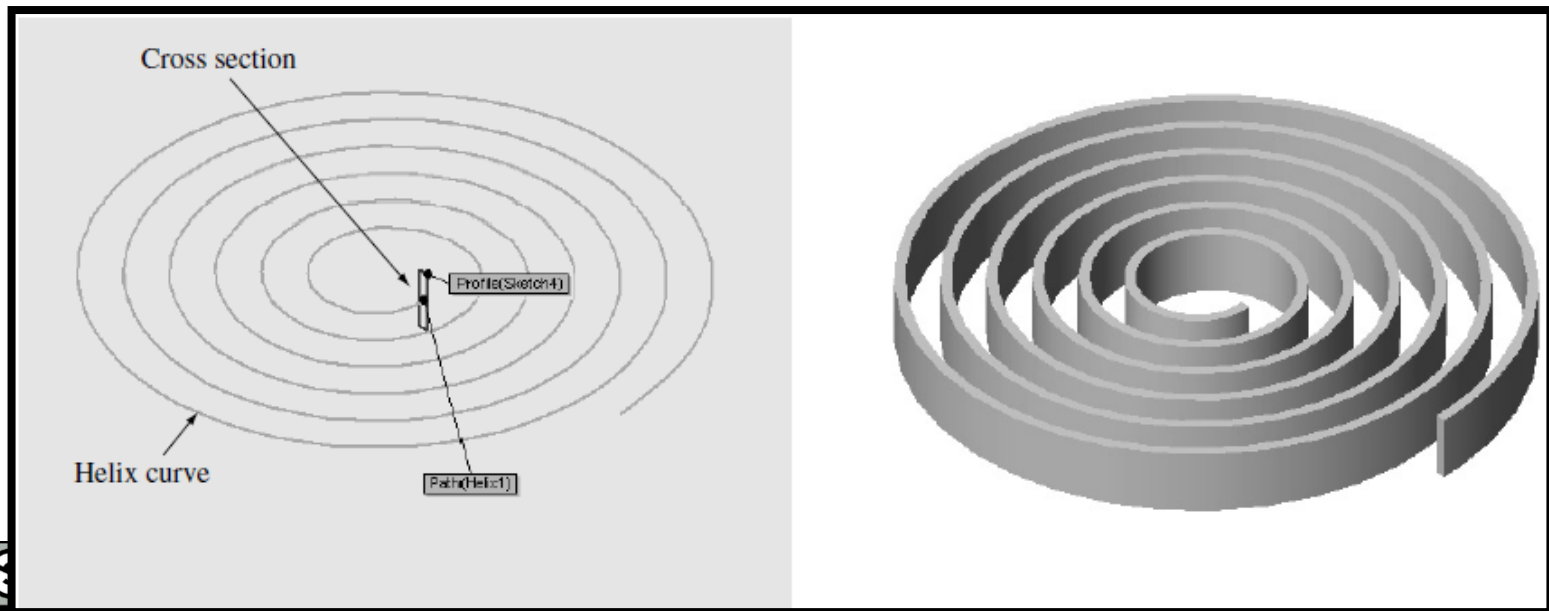


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# BASIC FEATURES FOR 3D MODEL

## SPIRAL

- Create spirals (considered a sweep along a helix curve).
- Requires a cross section and a helix curve.
- Helix curve requires a pitch and a number of revolutions.

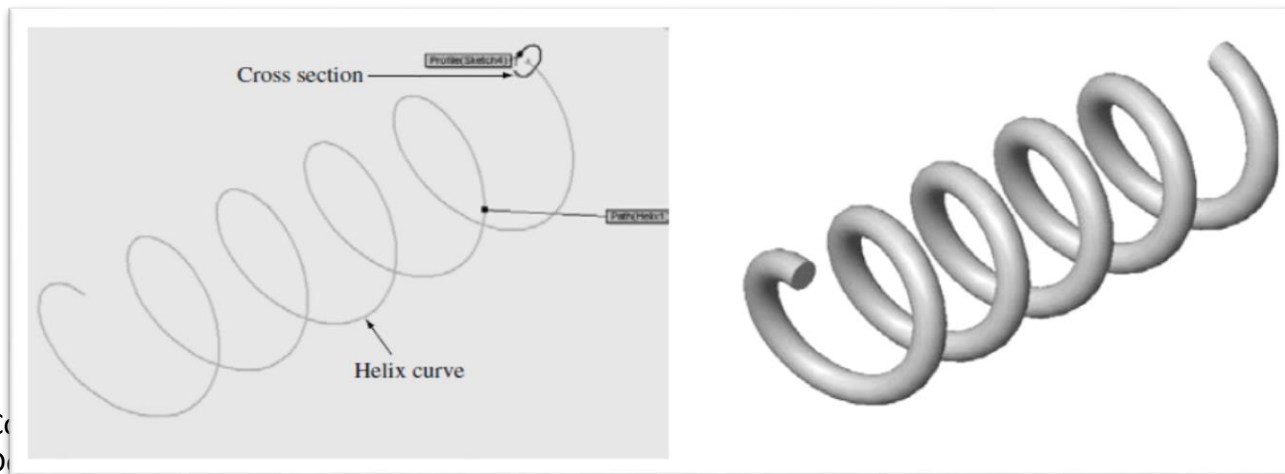




# BASIC FEATURES FOR 3D MODEL

## HELIX

- Create helical springs (considered a sweep along the helix curve).
- Requires a (circular) cross section and a helix curve.
- The helix curve requires a pitch and a number of revolutions.
- Helix can be created tapered if needed.



# DATUM FEATURES

- The creation of a solid model begin with a sketch that is used in conjunction with a feature operation to create features.
- A CAD system makes the assumption that any geometry created during sketching is part of the profile under construction.
- Datum features need to create in order to define construction operation and they are not part of the profile.



# DATUM FEATURES

## Reference Geometry

- Special type of geometry uses to define other geometry.
- Part of the feature definition, and it cannot be deleted unless the feature is deleted first.
- Datum features can be in the form of planes, axes, curves, points, and coordinate systems.

### Example:

Cross section and the axis for creating a revolved feature.

The cross section is ordinary geometry, the axis is reference geometry.

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# DATUM FEATURES

## REFERENCE GEOMETRY:

Comes the form of datum features.



Datum plane

Use when a nonstandard construction plane is needed.

Datum axis

Use for various purposes including defining an axis of revolution for revolved features or an axis for a circular pattern.

Datum curve or point

Use to create curves or points in the model database that are needed to define a sketch.

Datum coordinate system

Useful when need a CAD system to use it temporarily in some calculations instead using the MCS.



# Have any questions?



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Thank you  
and Have a nice day!



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