The Hitchhiker's Guide to 3D Solid Modeling

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Class Summary

You will learn the basics of 3D solid modeling using only ten commands. Included are practical techniques, tips, and caveats with real-life models.

3DORBIT	EXTRUDE	UNION
PLAN	REVOLVE	SUBTRACT
UCS	SWEEP	INTERSECT
UCSICON		

Key Learning Objectives

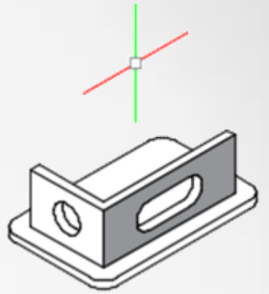
During this class, you will learn:

- The basic 3D solid modeling commands
- Practical solid modeling techniques
- Common pitfalls to avoid
- The minimum set of tools and essential information

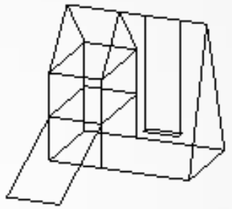
My goal is to give you a solid introduction, demos, and a roadmap to 3D solid modeling that will make you functional in an hour. To accomplish this goal, I will use as few commands as possible, and avoid overwhelming you with information.

Basic Definitions

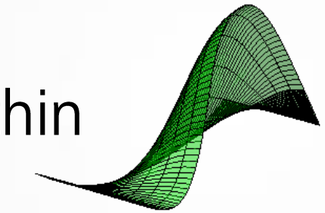
- Isometric drafting – illustrations in flat “2½ D”



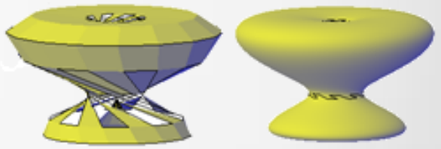
- Wireframe modeling – pipe cleaners



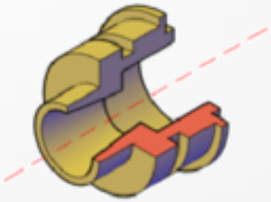
- Surface modeling – paper thin



- Mesh modeling – sculpting, smoothing chicken wire



- **Solid modeling – volume and mass**



Topics

- Common 2D Commands Used with 3D Solids
- Viewing in 3D
- The User Coordinate System
- Extrusion
- Boolean Operations
- Best Practices and Advice
- Next Steps

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Common 2D Editing Commands

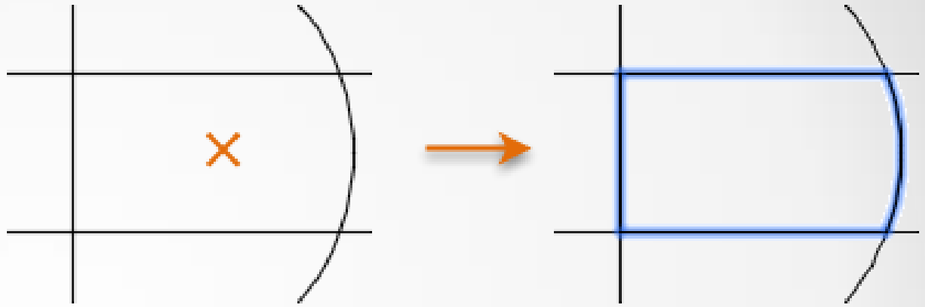
Used in 3D modeling

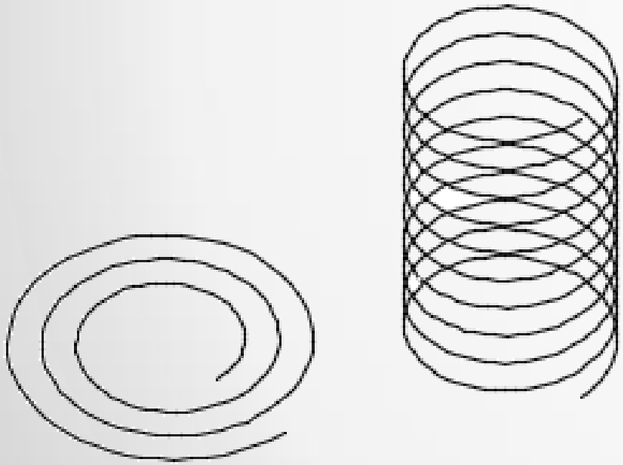
- MOVE, COPY, ROTATE, MIRROR, ERASE, PEDIT, FILLET
- Ortho mode [F8] and direct distance entry

Common 2D Geometry Commands

Used in 3D modeling

- PLINE, RECTANG, CIRCLE
- ★ BOUNDARY (plan view)
- HELIX (spirals, springs, threads)





Common 2D Inquiry, Visibility, and Controls

Used in 3D modeling

- ★ ID, MEASUREGEOM, PROPERTIES
- GROUP, UNGROUP for assemblies
- ★ Isolate and Hide objects on the status bar

- OPTIONS for behaviors and background colors
- WORKSPACE – browse the 3D Basics ribbon

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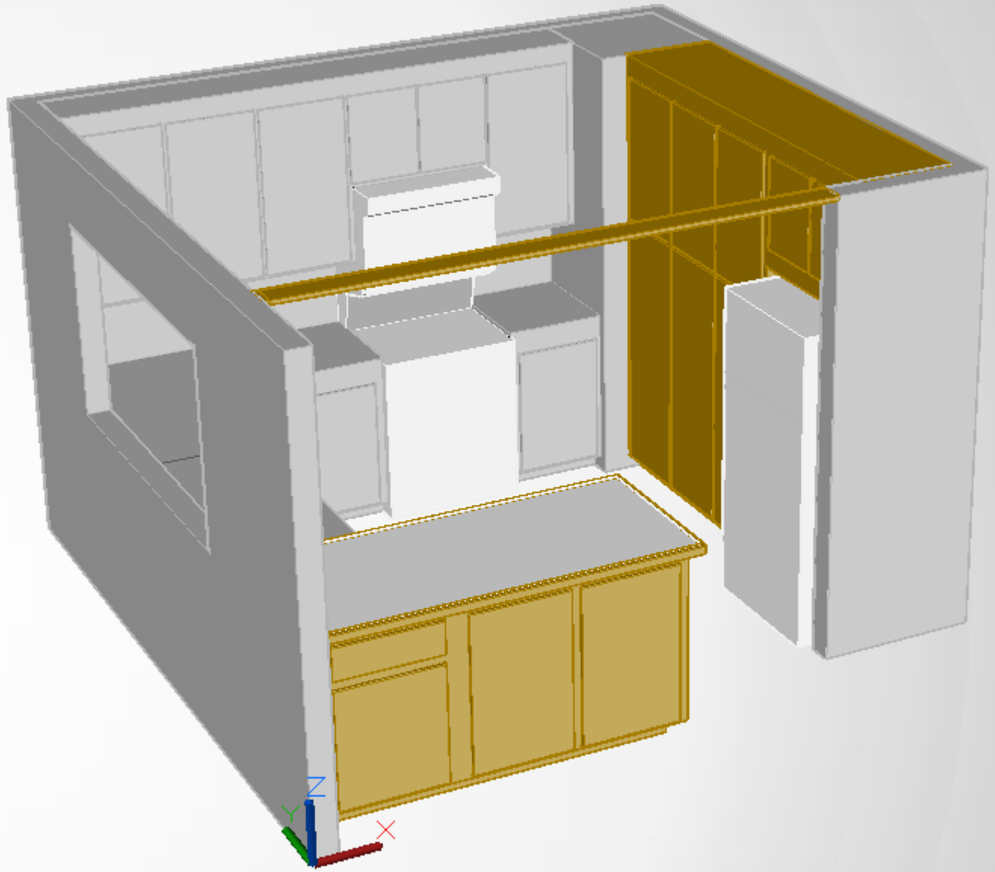
Viewing in 3D



- 3DORBIT (3DO)
  - Perspective or orthographic?
  - Visual styles (VS)
  - Options > Display tab > Colors
  - Quick: Shift + press mouse wheel
- PLAN
  - XY plane of the current UCS or the WCS
  - Note: Mechanical Design vs. Architectural conventions

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The User Coordinate System

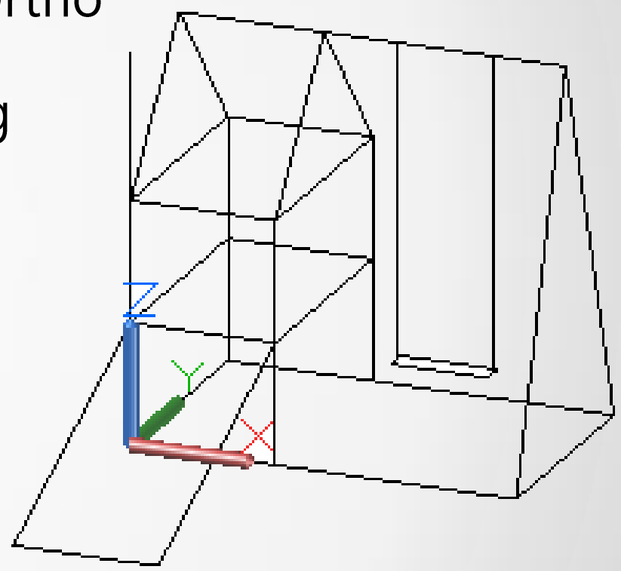
- What is it for?
  - Orientation: Construction plane for creating and editing 2D objects
  - Orthogonal directions: X, Y, and Z for direct distance entry, Ortho mode
  - Rotation: The Z axis is the “hinge”

Tip: Turn off dynamic UCS by setting UCSDETECT=0 [F6]

The User Coordinate System

- UCS – What are the most common options?
  - UCS 3P – Locating the XY plane for 2D geometry, Ortho
  - UCS ZA – Specifying the Z Axis direction for rotating
  - UCS World – Getting back
- UCSICON – Control the display of the UCS icon
  - Off for screenshots
  - On, Origin

Note: UCS display – 2D wireframe , other visual styles



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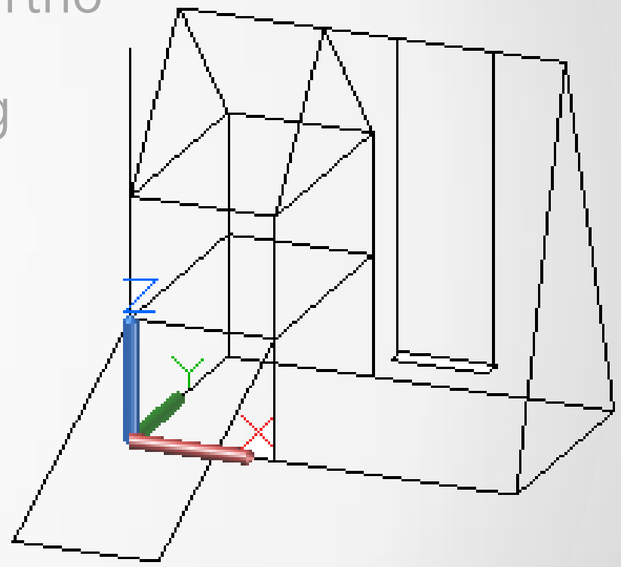

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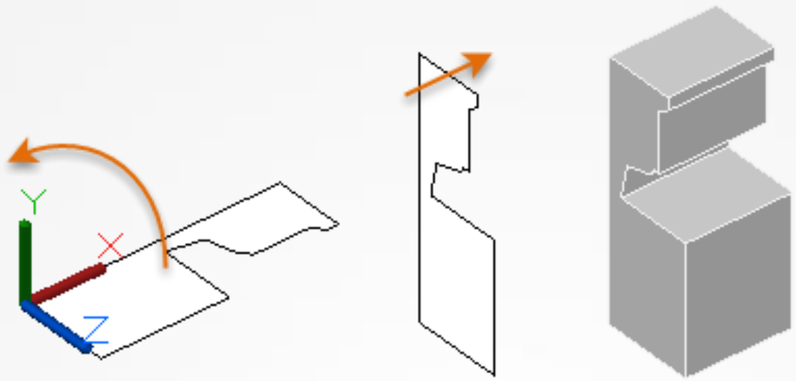
Extrusion

- EXTRUDE
- REVOLVE
- SWEEP



Tip: Set DELOBJ = 0 to retain profile geometry

- Why? Revise and reference
- Keep on separate Reference layer(s)
- Choose a distinctive color

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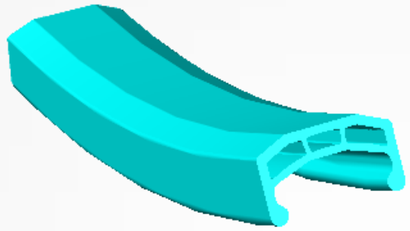

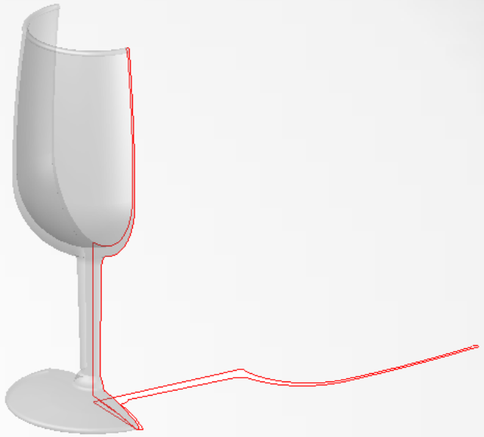

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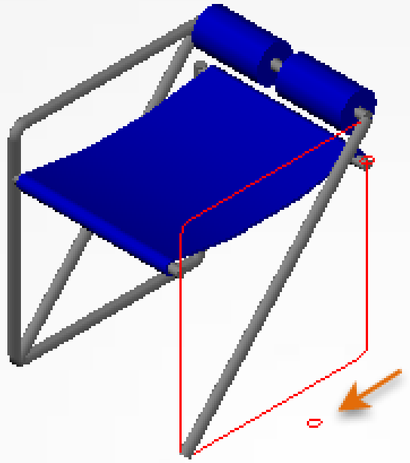

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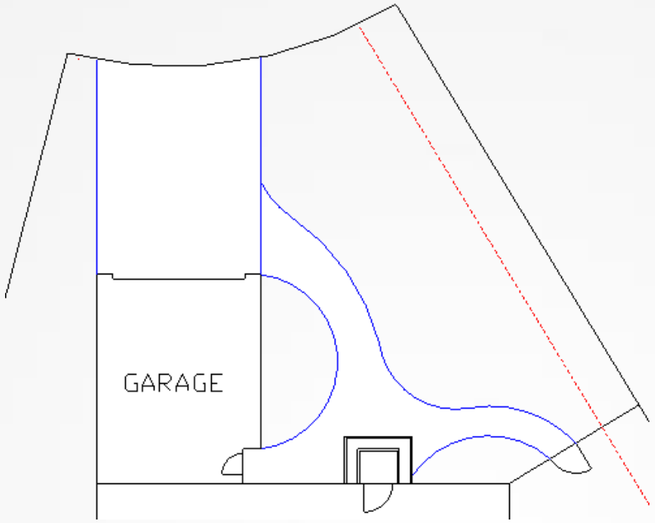
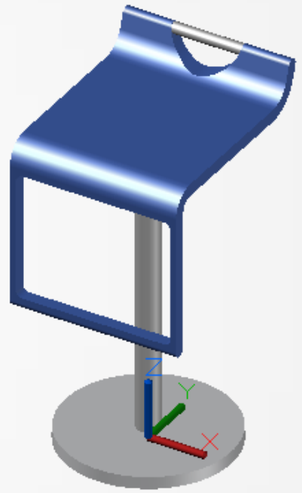
- SUBTRACT
- INTERSECT





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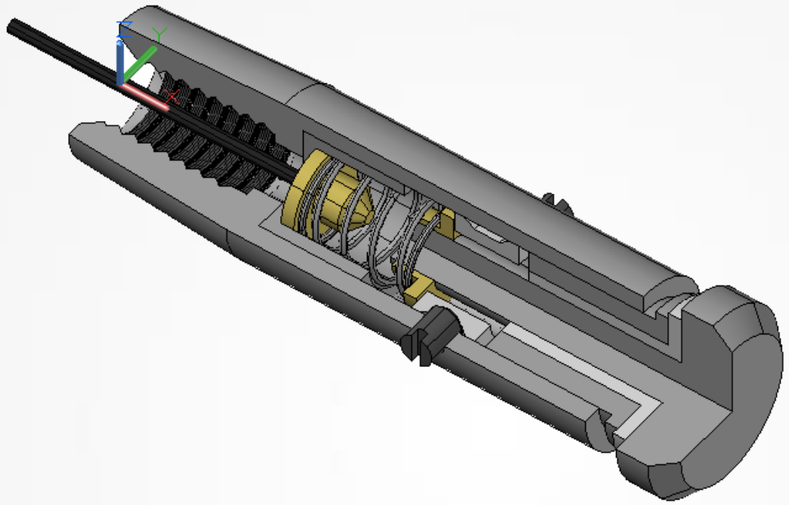

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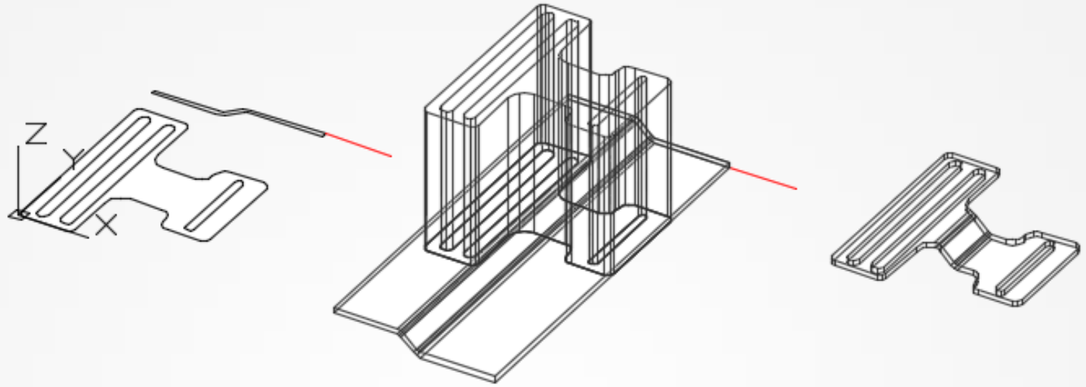

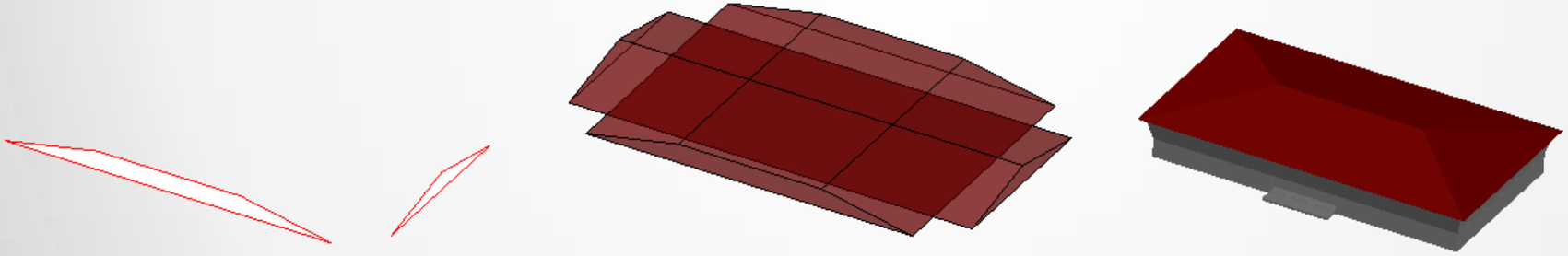

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Best Practices and Advice

- Learn using simple models, become comfortable with the commands
- Organize your model with layers to manage visual complexity
- Start by creating 2D objects: closed polylines and circles
- Move and rotate 2D and 3D objects into place
- Create and keep wireframe reference geometry (set DELOBJ to 0)
- Check and recheck distances and dimensions frequently
- Check geometry with 3D Orbit and orthographic views

More Best Practices and Advice

- Delay adding fillets to preserve sharp corners for measurement and placement
- Limit the detail to what is justified for your goals
- Make sure that you're on the right layer!
- Use GROUP to associate objects that you don't want to Union
- Create blocks from complex repetitive objects to reduce DWG size
- Save a version of a model at each stage so you can easily go back
- 3D landscaping – purchase it, insert as blocks

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Next Steps

- Review the presentation, try things with the 24 class models
- Create some simple models
- Review the Further Study section in the class handout
- Explore additional commands from the Basic Modeling workspace
- Create your own 3D workspace and drawing template files
- Experiment and have fun!
- My email: dieters@autodesk.com (might take a day or two)

Session Feedback

- Via the Survey Stations, email or mobile device
- AU 2014 passes given out each day!
- Best to do it right after the session
- Instructors see results in real-time