Make With SOLIDWORKS!

TTU Library Emerging Tech Workshop

Instructor Sean Scully

2025

Who am I?

Sean W Scully

Lead Administrator – TTU Libraries Makerspace

Rhino3D, TinkerCAD, AutoCAD Inventor, Fusion360, Blender, Solidworks

MakeCode, Python, Scratch, C++, C, MATLAB, Arduino, JavaScript, Assembly, Verilog,

Xilinx

BGS, Math/Engineering/Renewable Energy, TTU
MFA, Studio Art - Metals/Jewelry/Enameling, Kent State Univ
BFA, Studio Art - Metalsmithing/Jewelry Design, TTU
AA, Fine Arts, South Plains College

linkedin.com/in/seanwscully

Find me on the First Friday Art Trail, ffat.org, CASP Work Studio H

MAKER SPACE

RYAN CASSIDY | SEAN SCULLY | JAKE SYMA

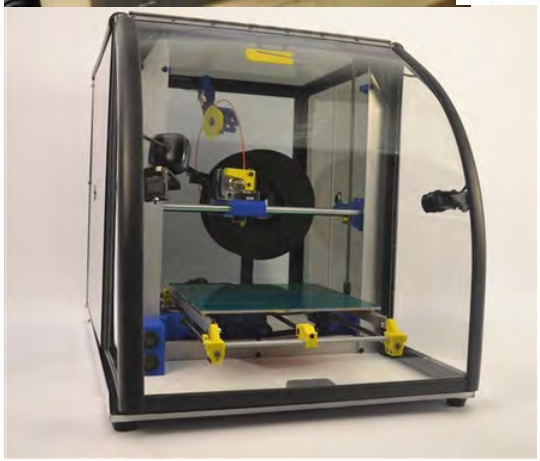
Emerging Technology Dept

- Makerspace: Main Library, 2nd floor, room 210
- VR Lab: Main Library, 2nd floor, room 201A

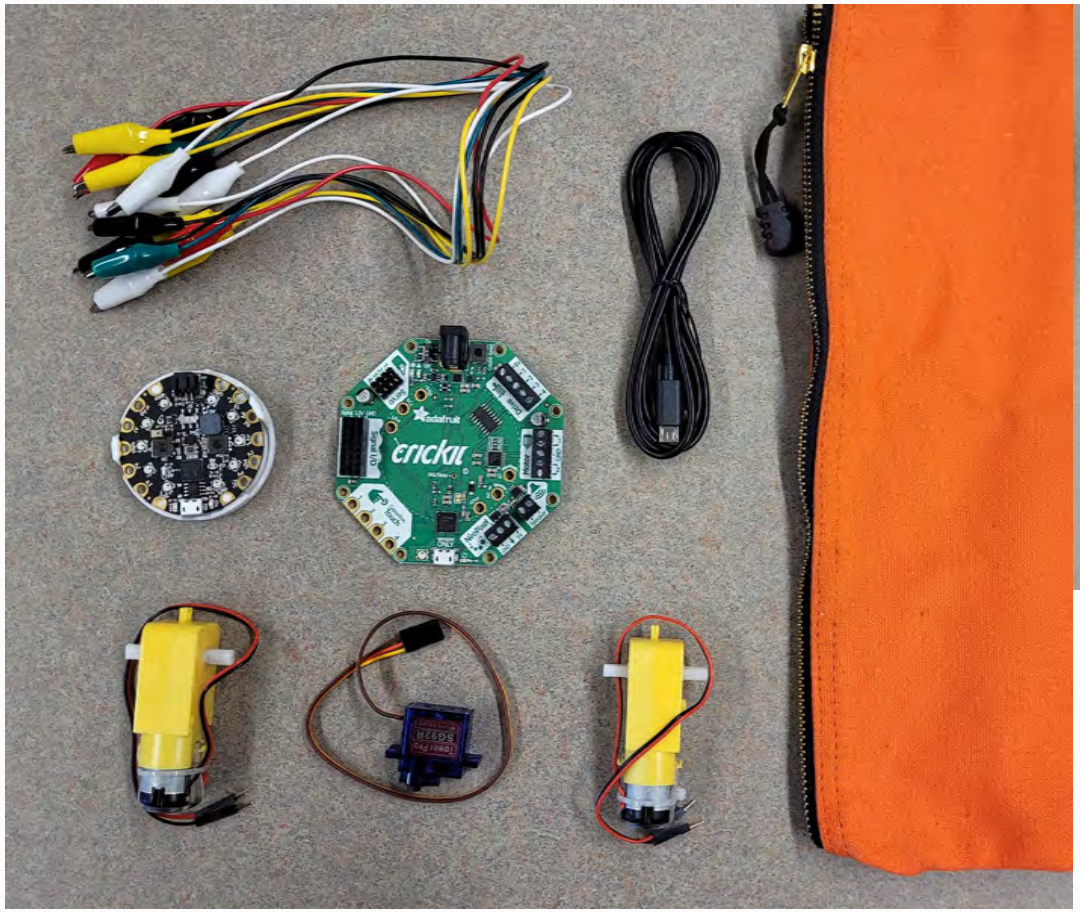
make@ttu.edu

https://www.depts.ttu.edu/library/make/

Virtual Walkthroughs - https://www.youtube.com/playlist?list=PLXiD4wAGiKu7iE0kYENiBLHtM9w-dAvFh

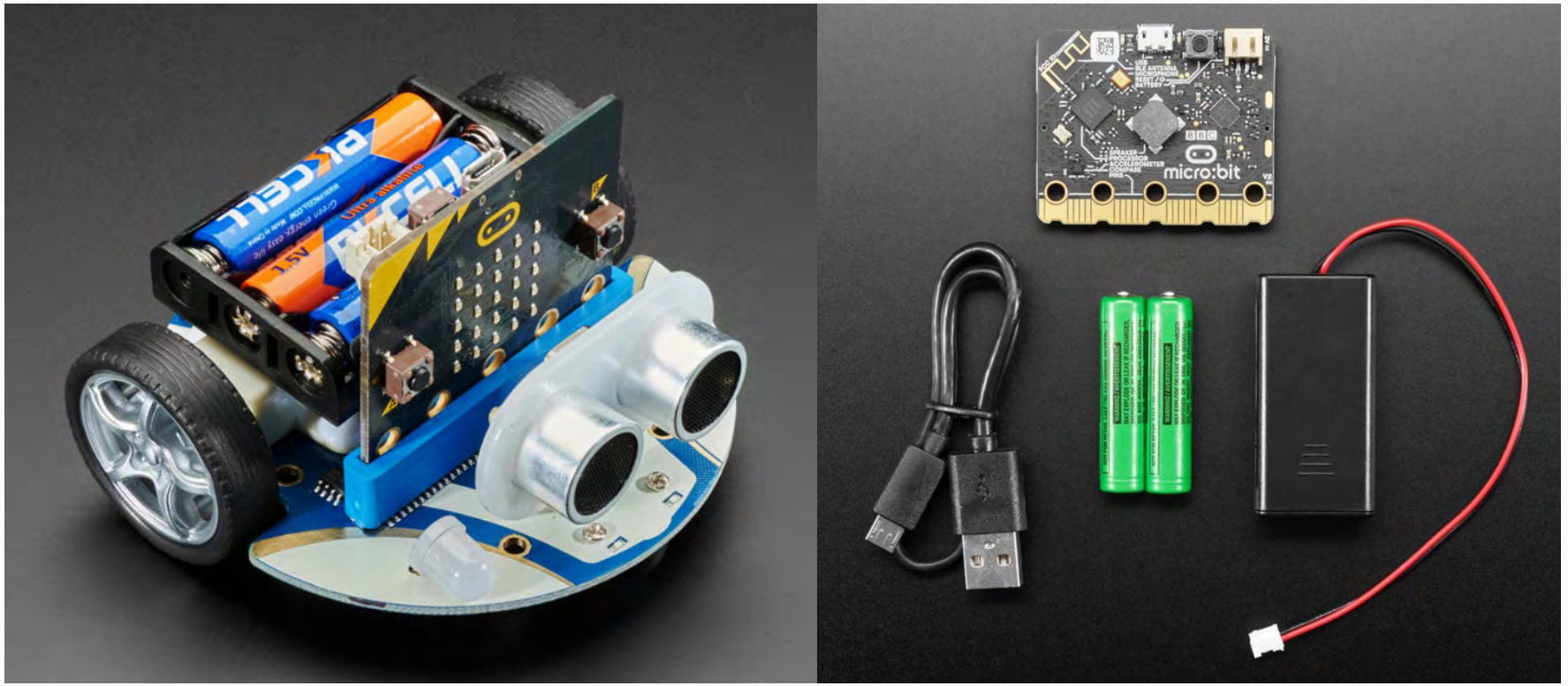


- Cricut Maker/Venture
- Glowforge Lasercutter
- Makyu Formbox
- Matter&Form 3D Scanner
- PolyPrinters 229 & 508
- Ultimaker 3, S7
- Sewing machines



- Robo Kits (15)
  - Adafruit's Circuit Playground Express (CPX)
  - Adafruit's Crickit robotic control board
  - geared motors (2), micro servo
- ElectroSoldering Kits (5)

TTU Library's Makerspace *CuteBot* and *Micro:Bit v2* Kits

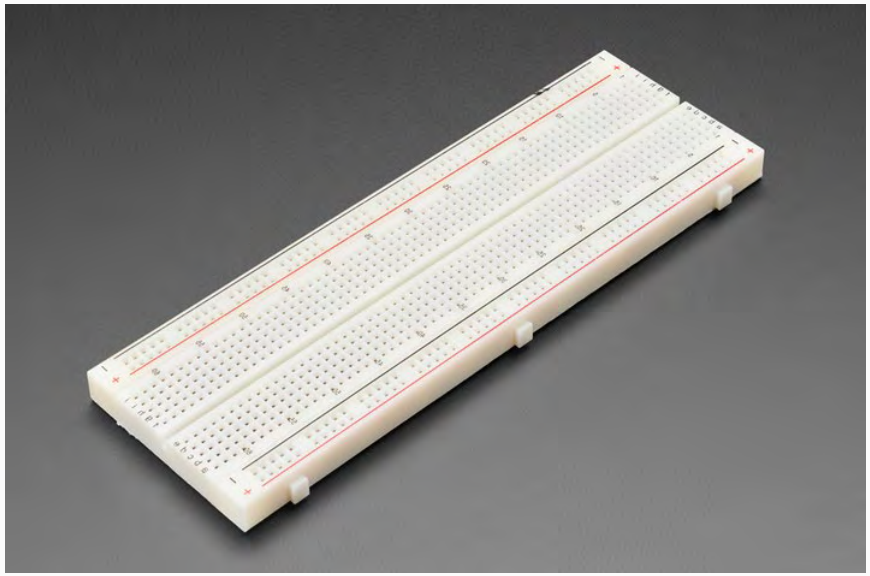


Images of our CuteBot kit and Micro:Bit v2 kit

TTU Library's Makerspace *Pi-400* and *Pi-Zero W* Kits

6 kits of each is available: recommend supplying your own microSD card (minimum size: 8Gb)

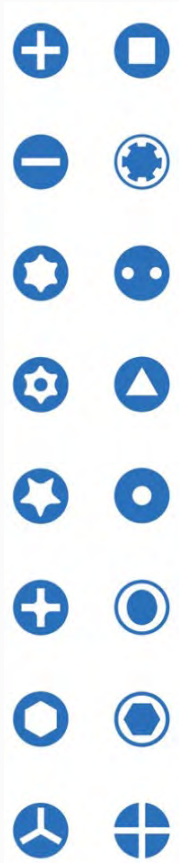
TTU Library's Makerspace *Pi – Interface* Kits



6 kits of each is available, one for every Pi-400

- Pi T-Cobbler Plus
  - GPIO Breakout - Pi A+, B+, Pi 2/3/4, Zero
- Full Sized Premium Breadboard
  - 830 Tie Points

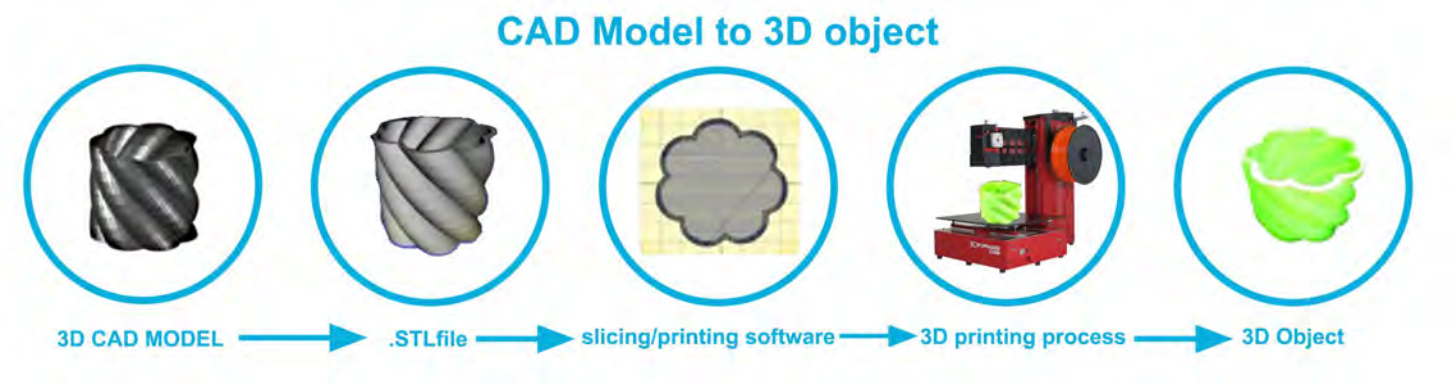
TTU Library's Makerspace *iFixit* Kits



6 kits of each is available, one for every Pi-400

- all kinds of screwdriver tips, 64 total
- larger kit has spudgers and plastic pryers

Overview


CAD Model to 3D object
3D CAD MODEL
.STLfile
slicing/printing software
3D printing process
3D Object

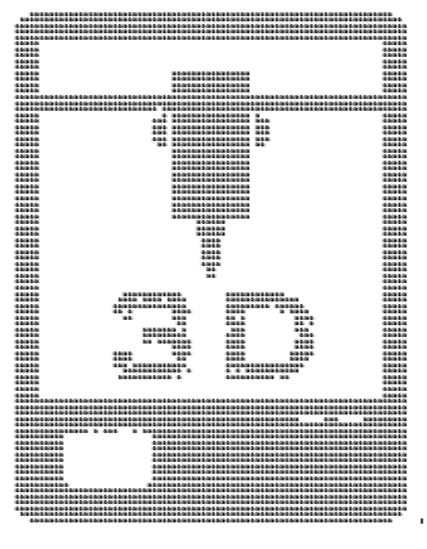
three common styles of 3D printer:

- Powder –layers of thin dust built with a binder
  - ZCorp., powdered cornstarch/gypsum, inkjet binder
  - Titanium/stainless steel powder fused with high power laser/plasma beam
  - Resolution varies widely, but generally the roughest of these processes

- Resin – Light-sensitive resin that hardens in layers as you expose it to images from an LCD, a projector or a laser beam
  - "Form" printers or LCD printers
  - Resolution high, measured in micron layer-heights

- Filament – Fused-Deposition-Modeling (FDM) using a stream of material that hardens/cools that will fuse in layers
  - FFF - Fused Filament Fabrication
  - Resolution varies with the printer extrusion parameters
  - 0.06 mm – 0.4 mm height x 0.4 mm width

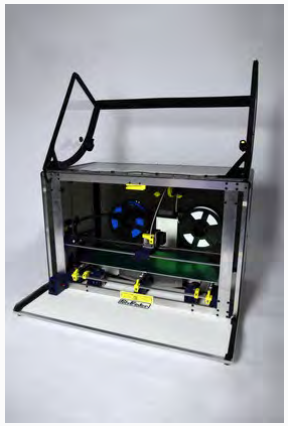
3D printing questions



- flat side down
- best to halve and glue
- minimize support material
- durability, temperature, solvents, requirements
- optimize thickness
  - efficiency/strength
  - limits of the printer (min thickness 0.8mm)
- orientation
  - direction for most strength
  - most precise/highest resolution

our PolyPrinters (229/508)

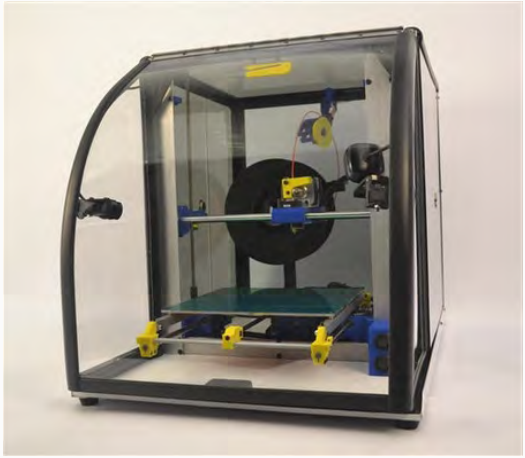
Layer height 0.25mm, width 0.4mm (0.4 mm nozzle)



Print volume maximums
- 229: 220 x 220 x 220 mm
- 508: 220 x 490 x 220 mm
- https://polyprinter.com/

Printers use 1.75mm diameter filament

Default material: ABS (Acrylonitrile butadiene styrene – a thermoplastic polymer)
- prints at 260-270C and print bed temperature of 110C
- fee of $1.00 for each print bed/color used
- 10 cents/gram of filament used



NinjaFlex (a brand of TPU filament – thermoplastic urethane)
- prints at 230-250C with print bed temperature of 60C
- fee of $1.00 for each print bed/color used
- 30 cents/gram of filament used

For models that only fit on 508, bed fee will be $2.00

PolyPrinter - Additional Reference

UTA EE Labs – PolyPrinter Walkthrough

- https://www.youtube.com/watch?v=ElMy8vTiJOM

PolyPrinter FAQ

- https://polyprinter.com/content/UserQuestionsAndAnswers/UserQuestionsandAnswers.html

PolyPrinter Manuals/Documentation

- https://polyprinter.com/downloads/
- https://polyprinter.com/content/229_508%20User%20Manual.pdf
- https://polyprinter.com/content/NozzleChange.pdf

our Ultimakers 3 + S7

Layer height 0.06-0.3mm
Layer width 0.4mm
0.25mm, 0.4mm, 0.8mm nozzle options

Print volume maximums

- Ultimaker 3:
  - *230 x 190 x 200 mm*
  - *https://ultimaker.com/3d-printers/ultimaker-s3*
- Ultimaker S7:
  - *330 x 240 x 300 mm (13 x 9.4 x 11.8 inches)*
  - *https://ultimaker.com/3d-printers/s-series/ultimaker-s7/*

Printers use 2.85mm/3mm diameter filament

PLA/ToughPLA/Nylon/TPU/PP plastic

- Fee of $1.00 for each print bed/color/extruder used
- 30 cents/gram of filament used

Breakaway PLA/Dissolvable PVA plastic

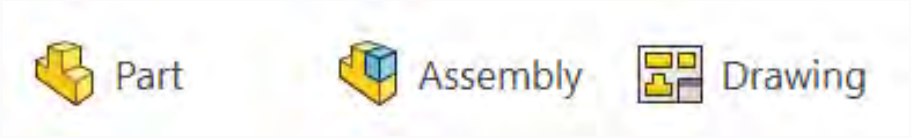
- Fee of $1.00 for each print bed/color/extruder used
- 30 cents/gram of filament used

Samples Samples Samples

- Always print the challenging portions of your project
  - *Saves time and material*
  - *Gain specific knowledge of printer limitations*
  - *Speeds design iteration timetable*
  - *Ensures success*

- Rhino & Blender (formerly used 3D Builder)
  - *Preview and repair STL files*
  - *Chop parts into pieces: "Split"*
  - *"Settle" parts: add gravity to ensure good bed adhesion during printing*

- Practice challenging prints from model repositories (free)
  - *Thingiverse*
  - *Cults3D*
  - *yeggi*



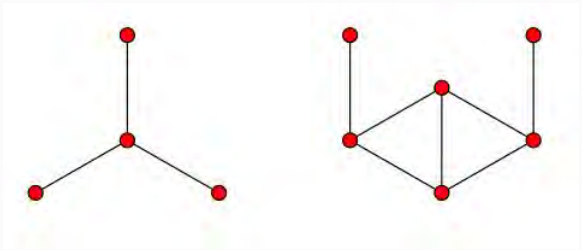
A Brief Intro to SOLIDWORKS

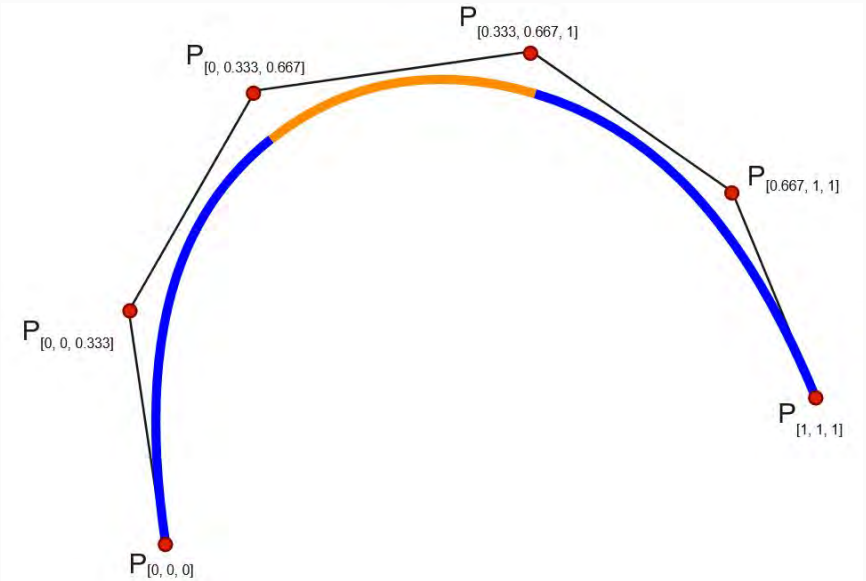
About advanced CAD programs

SOLIDWORKS

What is CAD made of:

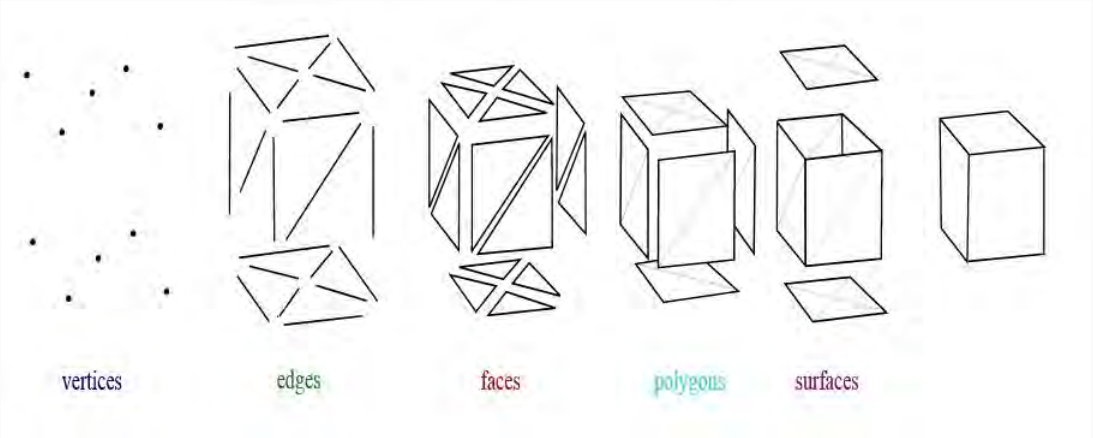
- Points
  - *1D object, coordinates (x,y,z)*
- Lines
  - *two+ points connected*
- Splines
  - *parametric curves*





Polysurface versus Mesh:

- *Points*
- *Surface*
  - 2D area defined by at least two lines
- *Polysurface*
  - 3D vol, two+ surfaces
  - Open – holes in model
  - Closed – “watertight”
- *[Polygon] Mesh*
  - Vertices = Points
  - Edges = Lines
  - Faces ~ Surfaces



getting started - filetypes

- Most common file formats you might deal with are:
  - .IPT, .IAM
    - Part file (.ipt) – each object you build
    - Assembly file (.iam) – file for importing parts and deciding their relationships
    - Autodesk-specific file types
  - .STL (Surface Tessellation Language file)
    - a system of triangles, originally for stereolithography
    - The standard used by slicer programs for 3D printing
  - .DWG, .DWF, .3DM
    - Editable CAD files – more general information about 3d objects/drawings
    - Used by Autodesk Suite and several other programs

https://fileinfo.com/filetypes/cad

getting started: SOLIDWORKS

- http://www.solidworks.com/sw/support/downloads.htm

- On-campus Computers (already installed, eraider login)
  - Library's 2nd floor: 3D Animation Lab room 205 (only on 2 computers)
  - Engineering Computer Labs

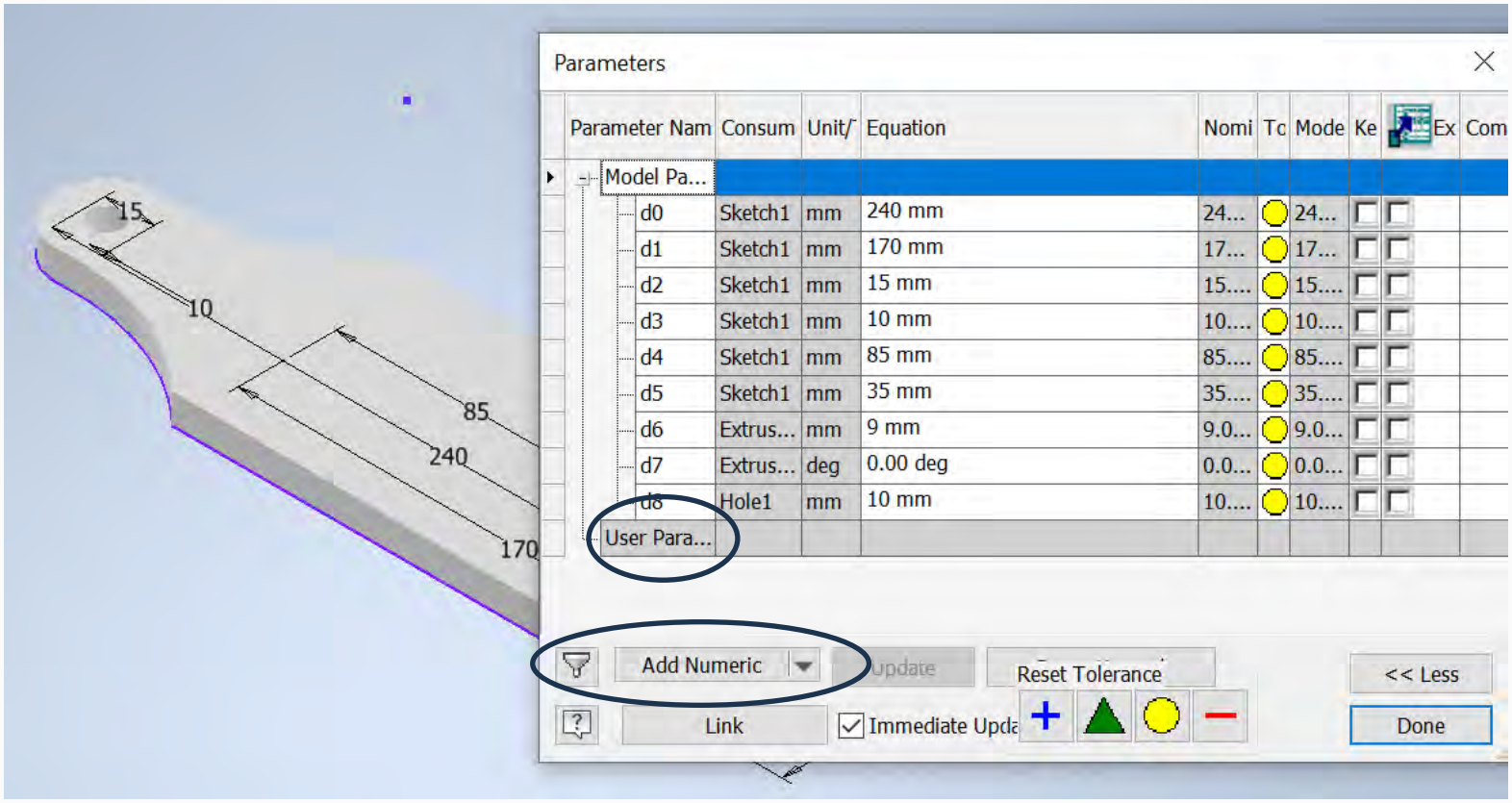
- @Home - Recommended hardware
  - Internet connection (only required for installation)
  - https://www.solidworks.com/support/system-requirements
  - Two-button mouse with a scroll that can click
  - A 64-bit Win11 system with a non-integrated graphics card is ideal
  - Mac users require a virtual machine which can significantly change the user experience

- Educational Install
  - https://www.solidworks.com/community/3dexperience-login
  - https://my.solidworks.com/try-solidworks

sketches - Body / Part - Assembly

- Sketches
  - Best place to start building/modifying your model
  - Drawing aligned normal (perpendicular) to a particular plane X, Y, or Z
- Body
  - Extruded sketch
  - Model object and all of the modifications (chamfer/fillet/extrusion)
- Part
  - A file for each modeling object
- Assembly
  - Separate file for importing/arranging Part files

Parametric Modeling – User Parameters



new features/tutorials

- new for 2025
  - https://www.solidworks.com/product/whats-new#brick--7869--default--en
- plier tutorial
  - https://www.youtube.com/watch?v=2mN7m2G5kCI&list=PLiKqXuECiKNK9bUR2xWG40x_AVK-jBbt9
- Solidworks Youtube Channel
  - https://www.youtube.com/@solidworks/playlists

onward: assistance is available

- The Staff and Student Assistants in the Makerspace are here to help!

- There are O'Reilly video and text tutorials available to help learn the more advanced software (Solidworks, Inventor, Rhino, Grasshopper, etc.) through Library Databases:
  - *Search for "oreilly" @*
  - *http://texastech-ml.hosted.exlibrisgroup.com/V/?func=find-db-1*

onward: 3D printing near me

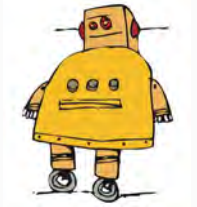
- On TTU Campus
  - TTU Library Makerspace – make@ttu.edu, Library 210, https://www.depts.ttu.edu/library/make/index.php
  - ATLC - Library basement, https://www.depts.ttu.edu/itts/services/3dprint/faqs.php
  - Architecture - https://www.depts.ttu.edu/architecture/
  - 3D Art Annex - http://www.depts.ttu.edu/art/Programs/graduate/studio_art/sculpture/index.php
  - Mechanical/Civil Engineering & IMSE
  - Ask your department – there are 3D printers hidden all over campus
- Off-Campus
  - ~~ULABS (Ubiquitous Makerspace) - http://www.ulabstx.org/~~
  - Science Spectrum - https://www.sciencespectrum.org/fab-lab/
- Online
  - ~~Shapeways - https://www.shapeways.com/~~
  - UPS - https://www.theupsstore.com/print/3d-printing
  - iMaterialise - https://i.materialise.com/en
  - MyMiniFactory - https://www.myminifactory.com/

projects galore

project-sharing websites (some require membership)

- https://learn.adafruit.com/
- https://www.hackster.io/
- https://www.instructables.com/
- https://hackaday.io/
- https://make.co/




Support/Forums/Discord

- Official forums/support
  - *https://my.solidworks.com/forums*
  - *https://my.solidworks.com/support*
- Unofficial discord
  - *https://discord.com/invite/MUYheHd*
  - *https://discord.gg/invite/solidworks-590336164549099520*
- Adafruit
  - *http://adafru.it/discord*

thank you!

please share your projects and progress!

"Make with Solidworks" with Instructor Sean Scully
review this workshop here:
https://ttu.libwizard.com/f/workshop-eval-24-25_emerging_tech

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Assoc. Librarian – jake.syma@ttu.edu
Workshop Guides- https://guides.library.ttu.edu/make