# FTC: Introduction to CAD/CAM

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# *Intro*

- CAD/CAM stands for **Computer Aided Design/Computer Aided Manufacturing**
- Can be helpful to **sketch** or **design** to **3D print** or cut via **CNC**
- By designing a 3d model, you can assure that parts fit in their intended assembly before buying them
- Can help create **computerized/digital assemblies or models** for ease of design along the design process
- For assemblies of robot, you can find bought parts from their respective **online vendors** (Pitsco, GoBilda, etc.) and import into your model
- Going forwards, becoming more advanced, it can be used to **simulate** real life conditions, testing certain builds without actually needing to build them
- There are many CAD softwares out there, but the main ones used for FTC are **Fusion 360, Inventor,** and **Solidworks**

# *Fusion 360*

***Recommended RAM: 4 GB***


- **Pros:**
  - **Cloud-based**
  - Runs directly on **both Windows** and **Mac OS**
  - Allows for **team collaboration** on **shared projects**
  - Has **simulation** features
  - **3 year free educational license**
  - Lots of material available so **easier to pick up/learn** for beginners

- **Cons:**
  - If you have **bad internet**, will **frequently** be **slow**
  - **Can't handle** as **complex builds** as **effectively as Inventor**

# *Inventor*

***Recommended RAM: 20 GB***

AUTODESK®
INVENTOR®

- **Pros:**
  - Runs directly on **Windows**
  - More **powerful/complex** than Fusion 360, so can handle more **complicated/intricate** designs
  - **1 year free educational license**

- **Cons:**
  - Since it stores files on your hard drive, **exporting files** will **not be as smooth/automated** as cloud-based softwares like Fusion 360
  - Thus, **harder for collaboration** of whole team
  - More **powerful/complex** than Fusion 360, so can be a bit overwhelming at first for beginners to learn
  - **Doesn't** run directly on **Mac OS**

# *Solidworks*

***Recommended RAM: 16 GB***

- **Pros:**
  - Can be **local or cloud-based**
  - Runs directly on **Windows**
  - Can handle very **large/complicated designs and assemblies**
  - Can export directly to **AR/VR applications** for even more immersed interactions with CAD models
  - **Best simulation tools/features** out of all the three

- **Cons:**
  - **Doesn't** run directly on **Mac OS**
  - **No free educational license**, instead only **perpetual** or **subscription license**

# Basic CAD Tutorial

- Most CAD systems are very similar, so here is our tutorial based on Fusion 360; No matter which system you decide on this tutorial will help
- Here's how to get started/how we got started:

Step 1: Get an Autodesk account

- Go to https://www.autodesk.com/products/fusion-360/students-teachers-educators
- Click Create Account (steps to creating should be self explanatory) and verify via email

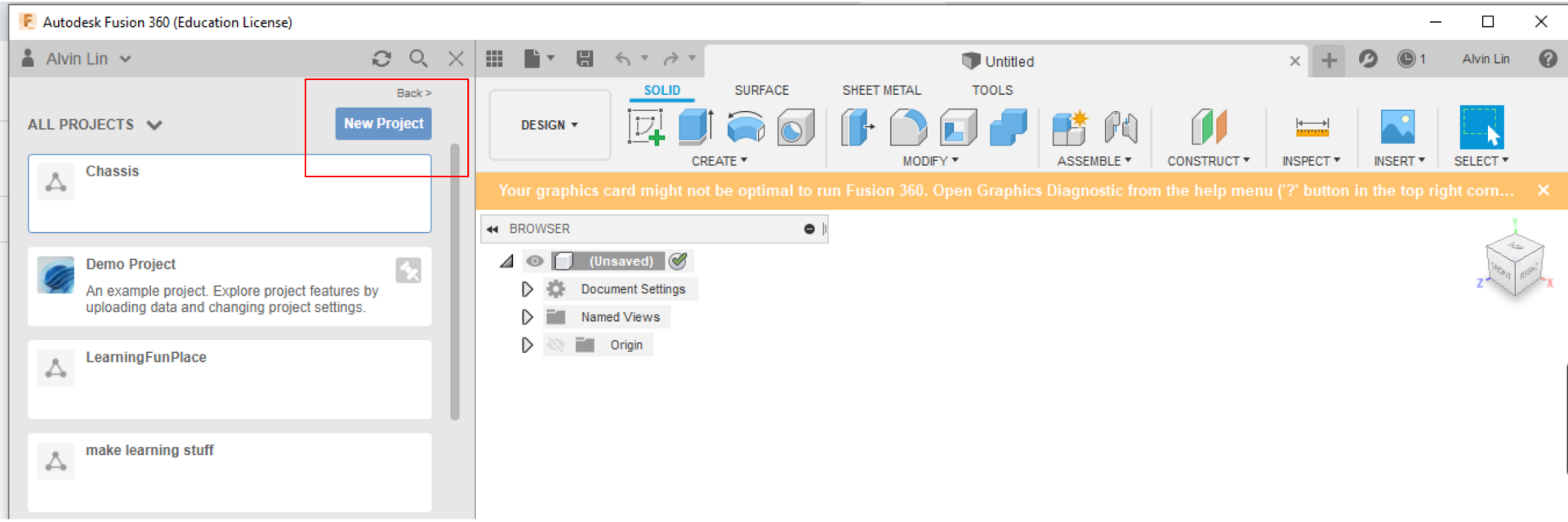
Step 2: Get access to the software

- Go back to https://www.autodesk.com/products/fusion-360/students-teachers-educators
- Click Get Access, then Download and run the .exe setup file

# Creating Your First File

Step 3: Create your first project!

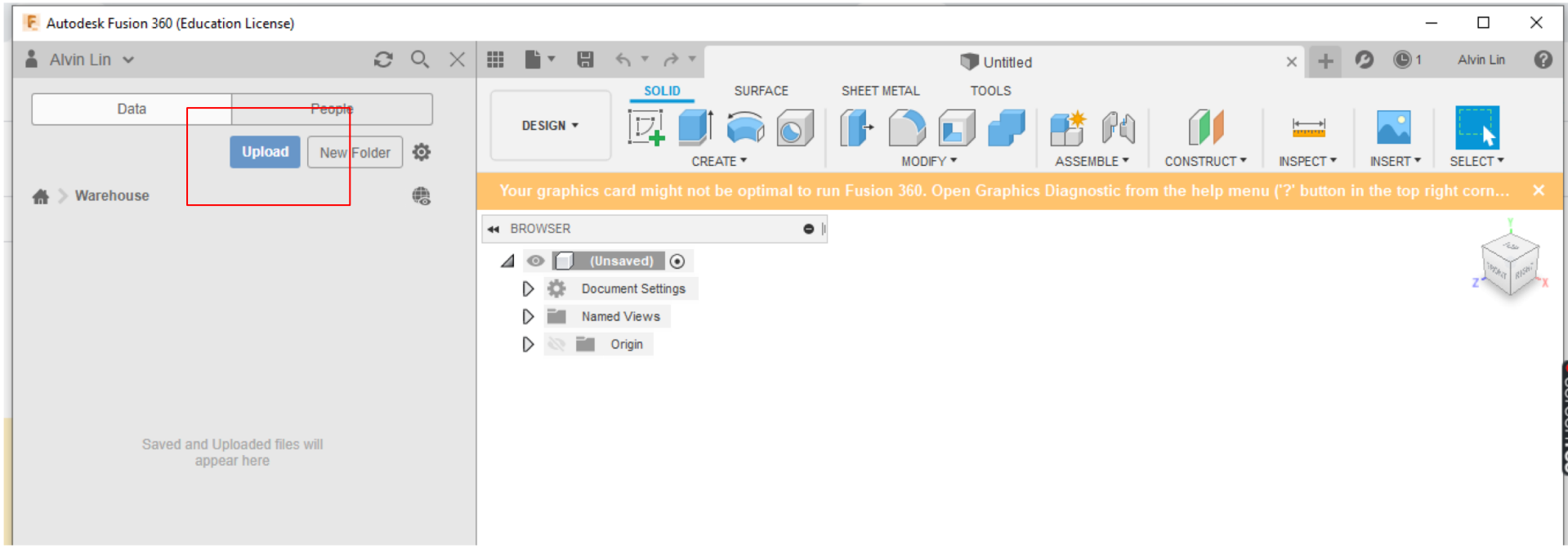
- After launching up Fusion 360 for the first time, you should see a blank workspace and a dashboard area to the left
- Click New Project and name it



# Learning to Use

Step 4: Learn to use

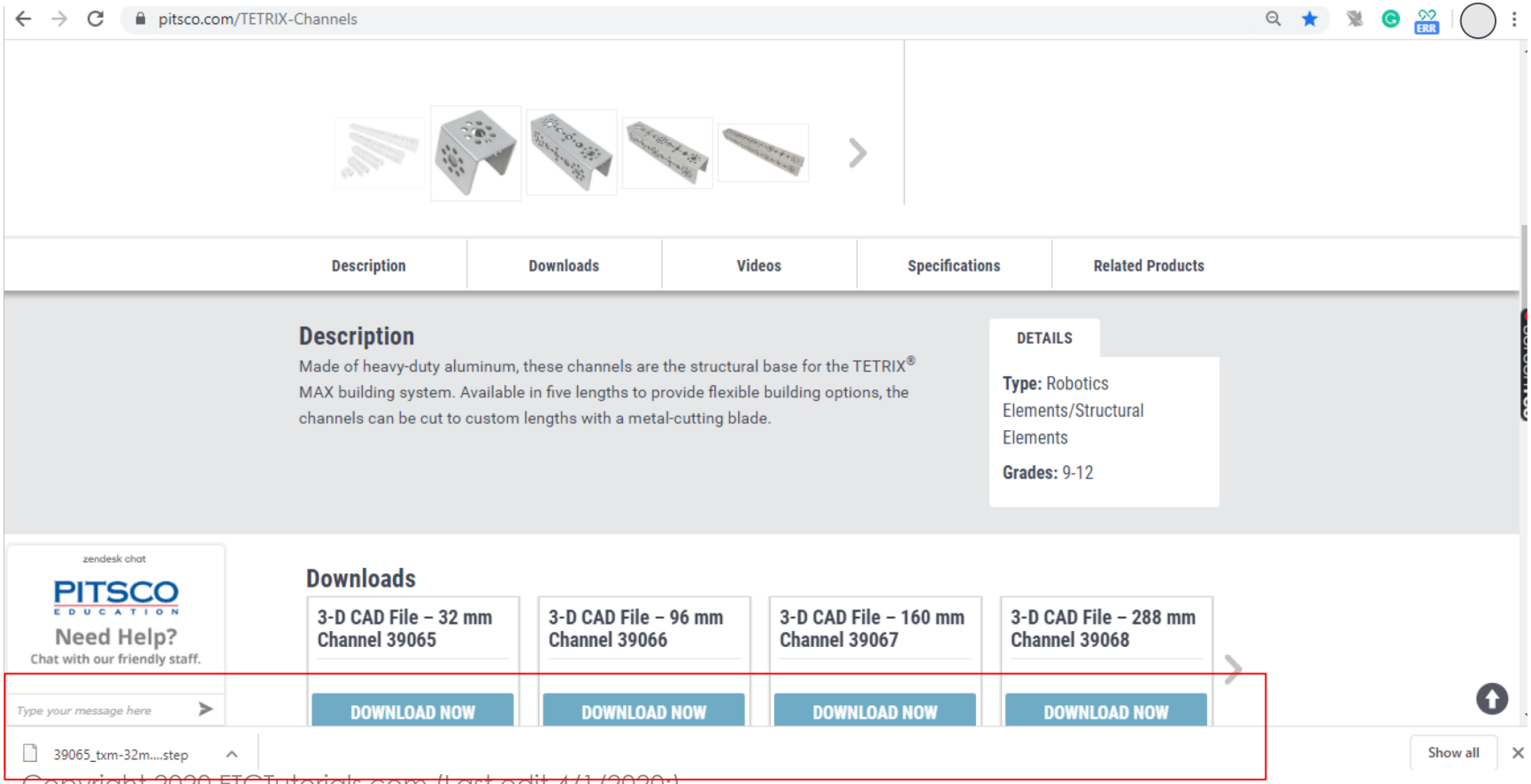
- Double click the project you just made to enter it
- You should see a blank project page in your dashboard area
- Now, you can upload files through the blue upload button
- In addition, anything you start making in the workspace can now be saved to your project



# Uploading Files

Step 4: Learn to upload

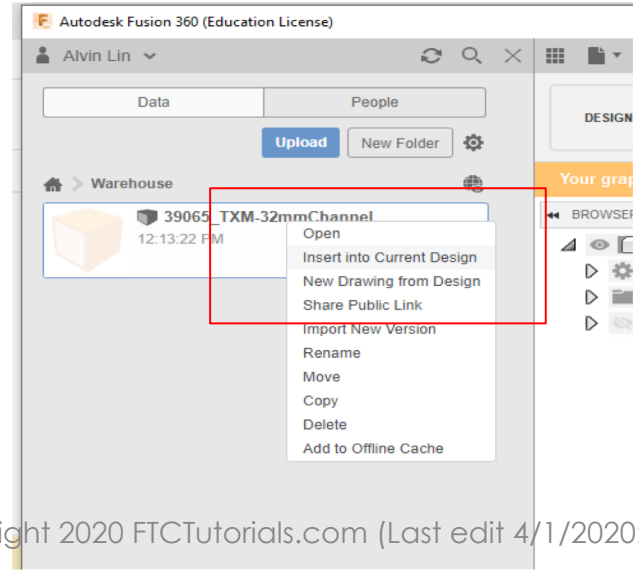
- Google up your desired component, and go to its product page
- Find an area for "Resources" or "Downloads" something of the like, in which you can download the component as a .step file

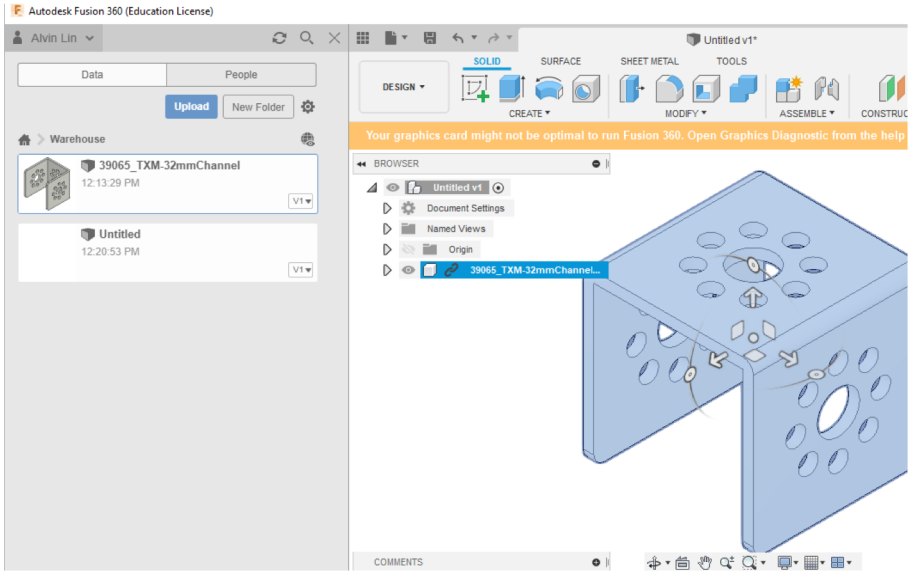


# Uploading Files

Step 4 cont.: Learn to upload

- Go to back to Fusion and click Upload. You can select what you just downloaded (may need to be unzipped) & upload it (may take a while)
- When done/**completed**, the file should appear in the dashboard area, now no longer blank
- Save the Untitled design to keep/edit it (In the future, version description when saving is good to fill out specifically to what iteration you made this session to keep track but is not necessary). Now it is in you project page dashboard area.
- Right click your component and click "Insert into Current Design", or simply click and drag it into the left (now blank) workspace
- Tada! You now have your first assembly!



# More CAD Tutorials

- That was just a brief basic tutorial to get used to the file structure of Fusion 360
- Uploading is great if you have existing parts or files from other sources
  - Will be used a lot in assembly, in which you put parts together to pseudo-build it and make a model there on CAD
- Other tutorials for other skills in CAD (sketching, animating, etc.) can be found online
  - Some personally recommended courses are:
    - Autodesk's own tutorials for Fusion 360
      - https://f360ap.autodesk.com/courses
        - https://f360ap.autodesk.com/courses/getting-started-in-fusion-360/lessons/course-overview -for beginners/to start off
    - Autodesk's own tutorials for Inventor
      - https://academy.autodesk.com/software/inventor-tutorial
    - SolidWorks lessons
      - http://solidworkstutorialsforbeginners.com/solidworks-tutorials-for-beginners/
      - http://www.solidworkstutorials.com/

# Credits

- This lesson was written by Alvin Lin for FTCTutorials.com
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