# Dual Extrusion 3D Printing

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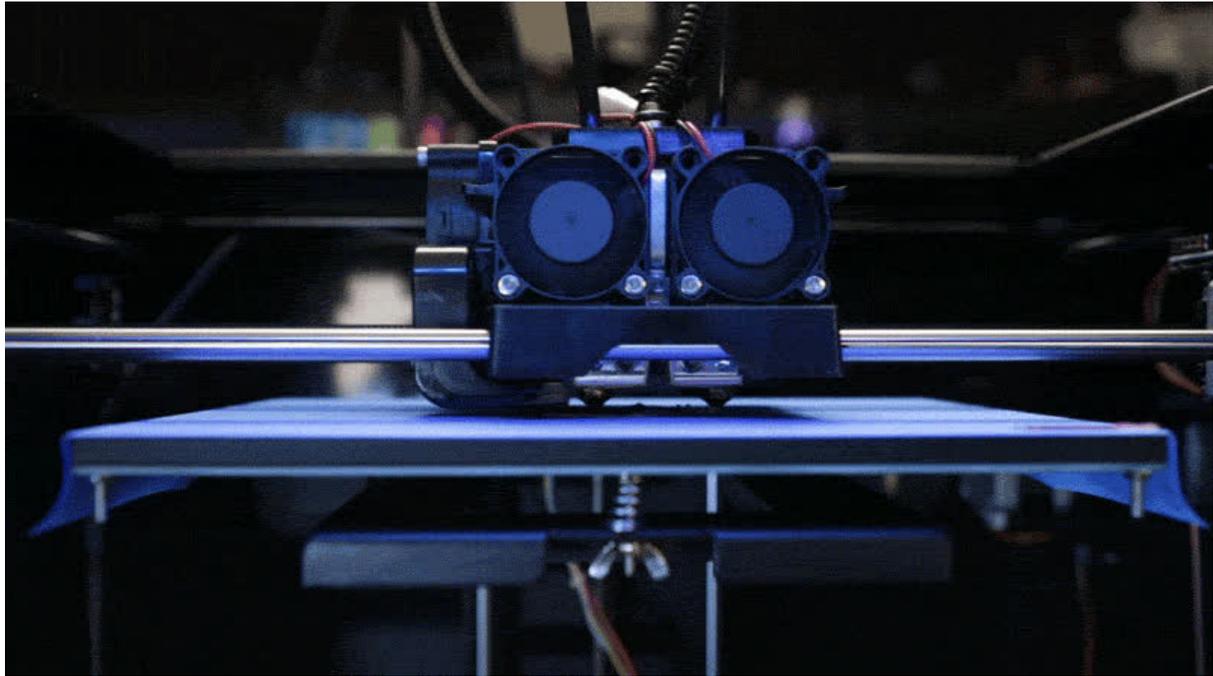
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# Overview

## What is Dual Extrusion?

Dual extrusion is the process of 3D printing with multiple filaments. You can mix colors or different materials with a print head that has two extruders and nozzles. With two spools loaded, the printer alternates between them by printing one at a time. It's not actually faster at printing because its still using only one extruder at a time. With this process, we designed these experimental projects that utilize different materials and colors.
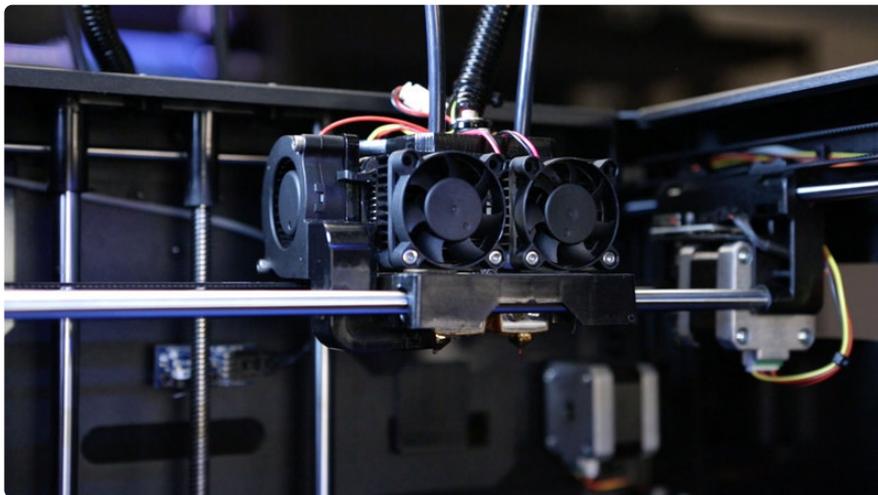


## Dual Extrusion Projects

We've created these projects below as a way to test and calibrate our dual extruder. Check out these projects below for more details.

- Coin Cell Battery Tester (https://adafru.it/Cg3)
- Wearable LED gloves (https://adafru.it/Cg4)
- Multi-colored Unicorn Horn (https://adafru.it/Cg5)
- Multi-colored D20 gaming die (https://adafru.it/Cg6)

## Dual Extrusion 3D Printers

These projects were tested on a Flashforge Creator Pro. This 3D printer features a MK8 spring-loaded dual extrusion direct drive system. It can print materials like Ninjaflex, ABS, PLA, Nylon and many more. Most dual extrusion 3D printers will need a printer profile to for a slicing application to process the models to dual print. In most cases, you'll need to assign a parts in two separate STL files to the two nozzles and configure settings depending the model features and materials.

# Designing for Dual Extrusion



## Predesign Process

Before designing your project, think about which features you want to be printed in different material or colors. Do you want your project to be just multi-colored or multi-material?

A good example of multi-material projects combine ridge hard plastic with flexible TPE filament. With this, we could make hard mounting brackets with flexible joints.

- Wheel axle with rubber wheels for a tire.
- VR googles, flexible hood with ridged enclosure.
- Embed circuits with outter hard shell and internal conductive traces.

These are just a few ideas. There's all sorts of exotic filaments these days so try to experimenting with composite metals, wood, nylon, temperature-color-changing material and many more!
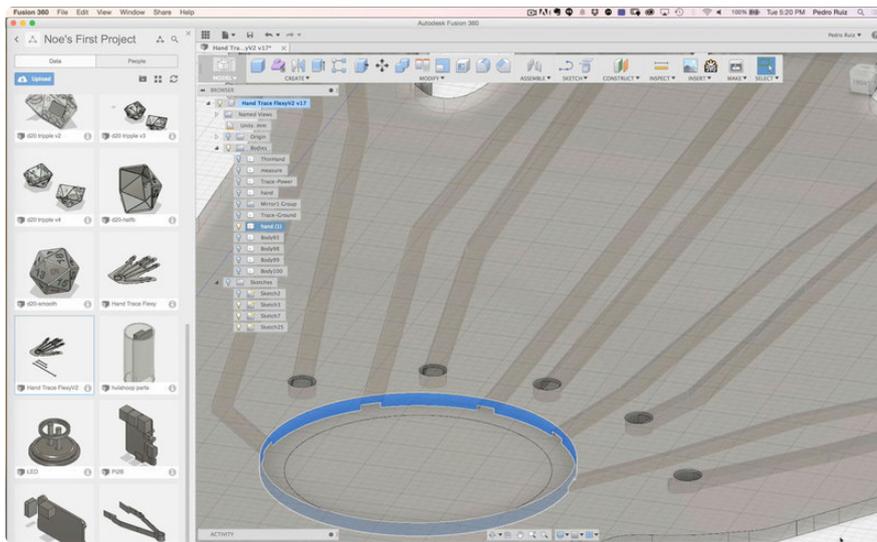
# Designing Parts

Once you've determined what properties you want your project to have, then you can start designing the parts. There isn't too much difference you need to make while designing parts. The main thing to consider is you'll need to separate objects that will be printed in a different color/material.

- Use boolean opertion like subtract or void to split solid parts.
- Avoid intersecting parts. Solids will need to subtracted from each other.

# Project Examples

Here are a few things you may want to consider when setting up your designs.

- Conductive Traces

    - Subtract traces from main part to create channels.
    - Merge traces to make manifold objects.

- Flexible Joints / Hard Parts

    - Create custom seams with bendability in mind.
    - Subtrace joins from main parts

- Multi-colored Objects

    - Subtract colored features from main part.
    - Combine colored pieces to make a single file.

# Preparing Models

## Export STLs

Once your design is ready for 3D printing, you'll need to export your objects in separate files. Here are some things to consider when exporting.

- Objects must be manifold. No holes or flipped normals.
- Parts should be exported in their original orientations.

## Slicing STLs

In our dual extrusion projects we used Simplify3D to slice the parts. This slicing software features a Dual Extrusion Wizard which makes the process easier. Check our their guide on how to customize extruder choices in order to use another extruder to print support structures, rafts, infill, and more.



**Printing With Multiple Extruders**
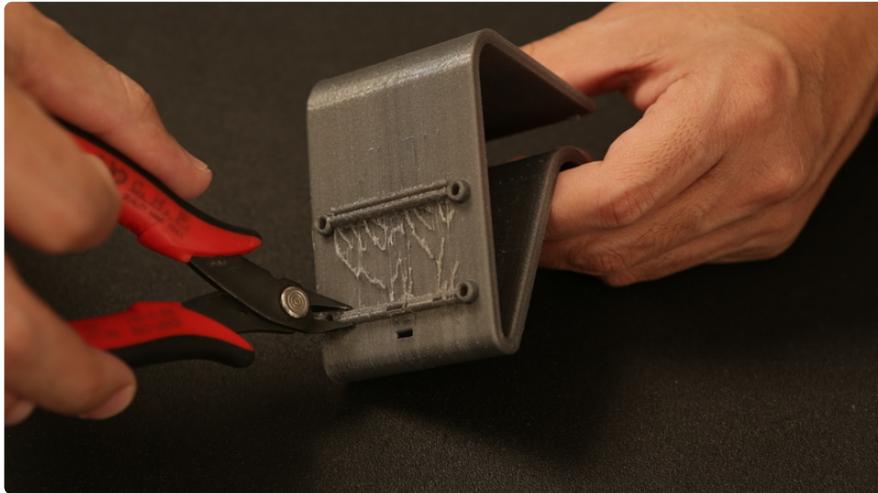
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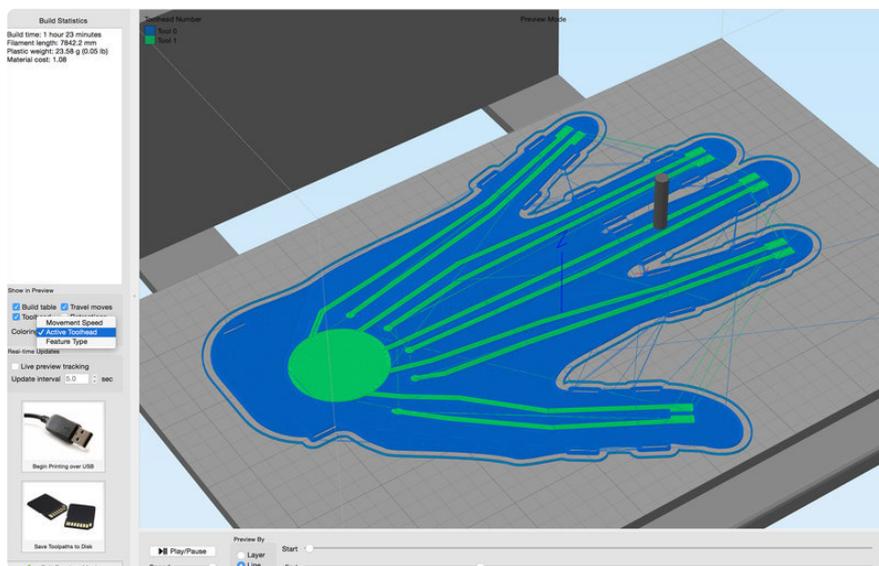


## Tips for slicing

- Check toolpath using feature type to preview individual layers and intersections.
- The right nozzle is referred to as Tool 0 (or color 1) and the left is Tool 1 (color 2).
- Always double check which filaments are loaded in the desired extruder.
- Throughly check first layer and live level if necessary.

# Clean-up and Finishing



## Removing Supports

If your parts requires support material, you need to carefully remove them without damaging your part. Use a pair of flat pliers to break the support structures away. Grip the structures with the pliers, twist and slowly pull the material off.

## Removing bumps, string and excess

Sometimes the support material will leave behind some build lines on the surface of the part. You can use a hobby knife or palette knife to scrape these artifacts from the surface.

Use flush diagonal futters to snip off any string or bumps. The flush edge of the snips allow you to pick off any unwanted bits. Stringy excess may appear from the retraction during printing, simply pluck or snip them off.

> **d20-surface**
>
> https://adafru.it/idm

## Surface Quality

Depending on the features and geometry of your object, the surface quality will be variable. It may not be 100% perfect everytime.

No crossing means no oozing. Material won't oozle from the nozzle with parts that are around 34mm wide. That's actually the distance between the two nozzles (at least on a MK8 dual head). If your part is that small, the printer head won't cross over the part, avoiding any sort of oozing.

- Use the extruder closest to the active cooling fan for features with most surface area.
- Use extruder furthest away from cooling fan for details such as color.