okay this is going to be an introduction to geometric modeling uh you may have already kind of reviewed some of this material before or been introduced before so maybe it's a review for most of you but i like to go through uh the basics just to make sure we're all on the same page all right content here introduction to geometric modeling what is it right review of 3d modeling types wireframe modeling surface modeling and solid modeling and then overview of the feature based modeling so it's basically what i want to review for lecture here so introduction what is geometric modeling well we've been doing it quite a while we've been doing various forms of it uh over the past year and a half or so but you know really in terms of just geometric modeling uh the definition is the modeling is the process in which an object or part is created using a mathematical coordinate based representation of surfaces in a 3d space so you know how we're going to represent this model or this solid object is going to be some mathematical coordinate right so three main types here as we mentioned here before his wireframe modeling so this uses the simple external frames to represent the geometric model surface modeling uses external meshing to represent more complex shape geometric shapes and then solid modeling itself uses 3d shapes to create an object to represent a solid geometric shape allowing for operations such as cut and extrude so we'll talk about each one of these here so wireframe couple examples over on the right this this type of modeling is meant to show the frame of the object in the wire like lines representing the surface of the part you can kind of think of cad 3d in in a way essentially you're trying to make a drawing in three-dimensional space of all the important features of the part surface modeling is basically this is related to the wire frame meshing in a way so it's it's really kind of the the wire frame with a surface finish so a surface mesh is used to with the material filling in the outer frame of the model itself and adding a surface effect so typically there's no thickness in in the surface unless they're specified by the designer of the software this is typically things like we see uh you see in video games um or simplistic uh if we're just say doing um like plastic injection molding parts you're typically gonna have uh this is one of your modeling techniques because that's all you're really worried about is the surface right or a small thickness in that surface so solid modeling itself um cell and modeling is is really what we've been focusing on for the most part with our courses here uh so the three-dimensional modeling that we use for solidworks and and such it's typically that we've been doing is solid modeling so this is where you make a quote-unquote solid model in three-dimensional space uh so it's a solid geometric shape that allows you to add combining you know basically combining materials or extrusions or is subtracting subtraction of that solid material so cuts right so complex 3d shapes are created through a series of additions or subtractions of primitive shapes that we've seen so looking at some of those primitive shapes you know what what are the typical cuts and extrudes that we typically do well cones cylinders wedges you know spheres boxes are really the the main types you know pyramids and spheres tauruses so uh that's that's the typical simple shapes that really create everything else for the most part right so basic shapes to use to actually combine and create 3d objects in a primitive modeling atmosphere right so primitive modeling examples so using those simple shapes here we're going to basically pop them all together and make another shape right another object so this is here where we're basically putting them together that's your primitive modeling example getting into constructive solid modeling so when you start say doing it in constructive solid modeling this allows for boolean operations such as unit unions

differences intersections between simple 3d shapes so this could allow you to make cuts so here they're doing a union to make basically a general shape that they're going to remove from this other common part so this adds a bit more capabilities than you have with primitive modeling really that boolean effect is is big right being able to add or subtract feature based modeling so this is essentially that boolean um effect to this uh is really the main main part of this but now we're going through and we're modifying the part right we're putting features to it so feature based modeling builds its 3d models using a series of features so common features that we see are holes slots square square blocks rectangular blocks cylinders you know there's a bunch of different shapes we can make or features that we can put into our part the geometry of features are controlled by modifiable constraints and dimensions so we can actually go in and then modify say our bolts change size we want to make those bigger or smaller we can do that so we can go into that feature and modify it and this is where we see we can add those features well base blind holes we have a boss that we're doing so we're adding material we're putting through holes in counterbore through holes some patterns and we can actually go in and modify those features so this is what we're really used to with works right so those operations that we see again rather straightforward something you're you're really common with uh i know we've already done it this semester but that's our extrude operation so it's where we make a 2d shape here draw it in a two-dimensional plane that we're interested in creating the shape off of and then we go through and extrude it to some general thickness and this could be an extrude cut or sand boss base you know we're going to add material same thing with revolve operations we can add or subtract a revolution of materials so here we're taking a general profile and we have to then revolve it around an axis right and that axis can be any radius or distance away from that that axis and we can get basically a through hole so there's different operations where we see this being used especially for various types of thread and other things but actually when we start talking about threading this is where loft and sweep really takes place so creating a little bit more advanced features or a feature that follows a general direction or say path is going to be your sweep or loft operation so the differences between the two i mean they're pretty similar but really the big difference is on the lofting operation you have a changes shape here so sweep and loft operations involve an extrusion of a 2d profile along a path so we have this general 2d profile here we're going to project it along a certain path any given distance in this case we want to make say a picture frame or some sort of framing you can do that along that path and that creates that same profile along the path the lofting operation again is going to change and kind of merge into the new shape so you actually draw two different shapes and then you'll have an axis this will follow and again you'll project it and as that merges to the new shape it'll change its overall profile so you have to draw two different profile shapes to have it extrude and change so those are really the two other different types of operations used for for your typical operations i'm sure there's there's others that have been created but these are your your main types 3d modeling and design intent so another really important feature to your your real geometric modeling here is going to be your prep your your design intent here so it's always good to think about what you're creating how you're creating it so most modeling involves some taught some some thought uh to creating this model so what it what was your design intent how do you plan on developing it if it changes is it gonna be easy to go in and modify it that's a really big one because it could save you a lot

of time make your development more efficient so having that goal product or goal shape or design in mind is really a good thing for creating a model with some sort of design intent to it so creating this model with a planned purpose in mind can make an efficient modeling modifications for specific features so for instance maybe it was this part here um you're you're doing a spur gear set and you want to model the teeth to where maybe we make those finer or say more more robust it would make them thicker would it be easy to go in and just modify that profile and reproject uh the number of teeth on that you know if you think about it while you're creating it the first time yeah it might make it easy if you're not you might have to go in reconstrain a bunch of things or maybe you didn't make it to where it's really easy to modify and then you have to go through and essentially recreate the part as a new part so having that design intent can actually save you quite a bit of time so typically models have modifications right so this is typically why when we make our drawings especially this semester i don't know if you have all done this before but in my class where you're you're making your drawings that revisions list up at the top right where you write your name and say you know this is the initial design or initial drawing that revisions list is because of the modifications parts get in the future so going in and changing that part people can say all right well we change this bolt hole we changed the mounting pattern or the clearances and you can actually point to where you made those changes and why so that make sure that you don't necessarily say that send the draw wrong drawing to get machined and then have a bunch of parts that you can't use with the new model so again that's efficiency as well as saving money on potential mistakes so revisions lists are rather useful and getting used to them uh is is really a good thing um but other than that that'd be it for uh lecture this week um i will have a little bit of a homework finishing up the g-code but these are a few references that i've used for pulling pictures some of these are actually pretty neat because they have some extra material to them if you want to go to check out the links like the core websites are pretty neat because they have um really more about the cad modeling and solid modeling features all right but that's it for this week all right later

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