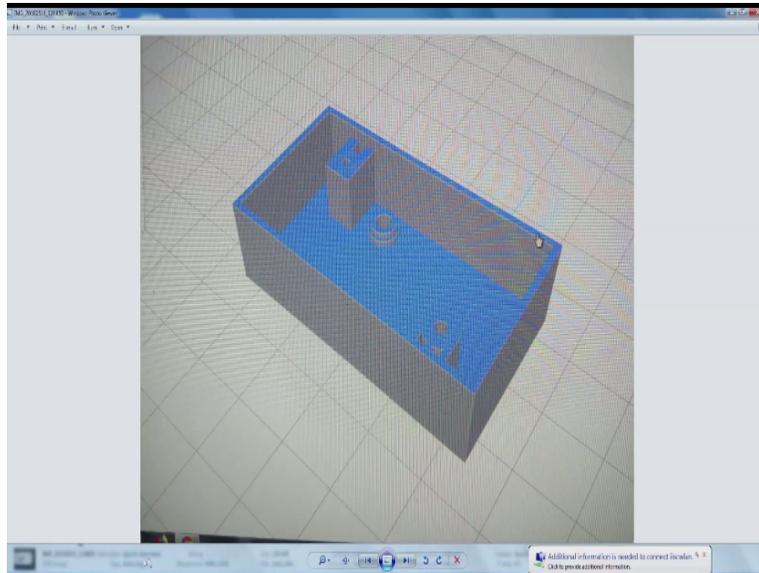


Physical Modelling for Electronics Enclosures Using Rapid Prototyping
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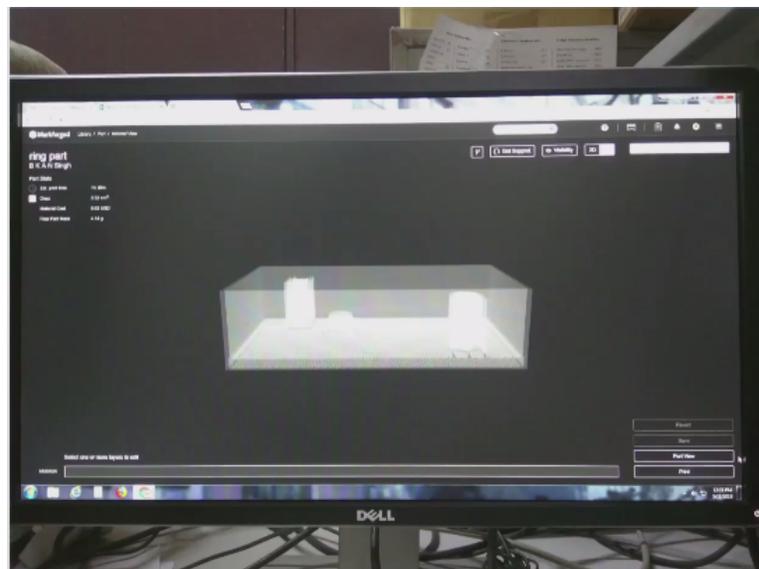
Lecture – 17
3D Build Up 2

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So we are able to actually build various things here.

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This is the machine builds up. It will show you the way what do you call whole thing is built up. You can see partly the inside of the object why is it required. In our case, it is opened and we are able to see without too much of a problem.

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But if you are to make something where the inside was not clear that is a very classical example is you have a cube and inside the cube you have a ball inside which is rattling inside not very long ago it could not be made or lot of tricks were involved. Now you want to make a cube with a rattling ball inside build the whole thing in 1 shot or I have shown you an epicyclic gear train. It looks nice after it is finished even in the screen it looks nice.

But in between when we want to do there is a planetary carrier, 1 triangular planetary carrier is there if you recollect is a planetary carrier is it rotating or it has got jammed. The only way to see is see the inside view so I will go on to the next thing.

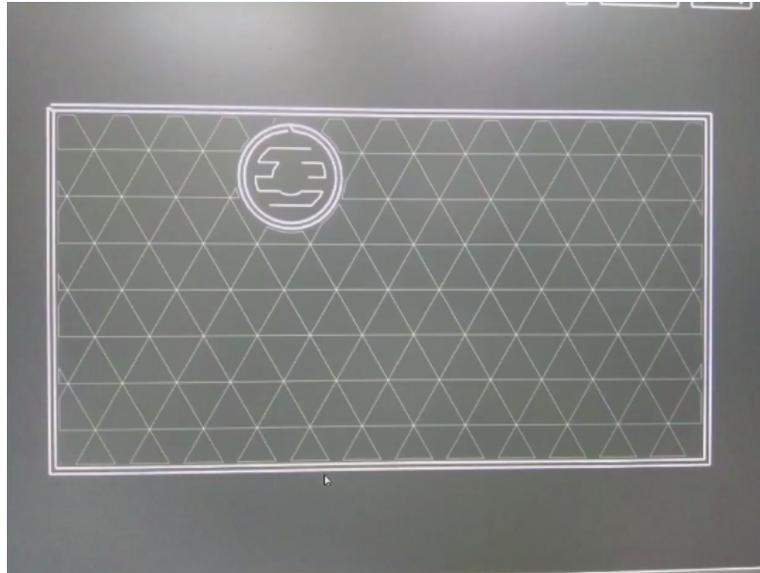
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This is the actually layup process as which it is being done. This is the bottom most part, this is probably a support layer, 2 things you see here is we have a full support of the whole object and outline is shown here. See there is an outline if it is little closer can you see here how material is being built up for a support. It is the same it is almost like this puzzles do you know where the child holds the balloon or do you know how to get out of this maze?

And almost like a maze this whole thing has come here it is go to this, it has gone here and 1 thread has stopped here you have seen this. Then there is another thread probably this thread belongs to this corner remaining thing is this. This is a reasonable way of building an object and you see here even the top most line it looks a little quite a lot like the puzzles and in fact we can give the puzzle and see how all it does. Next picture will show a little as things are getting build up slowly.

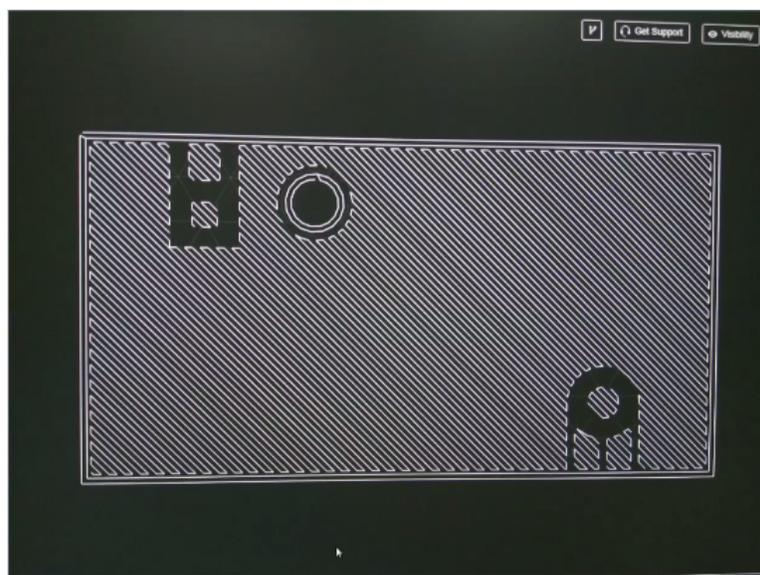
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You see that in case there is a solid. Depending on the type of the machine, depending on the type of what do you call preferences you set and saw and it is very rare but the whole solid is made into a muss. In order to make this if were to make this it is not correct make a bit lump of it like this and do it. It is easier if you make a honey comb structure here except it is a 3D honey comb structure.

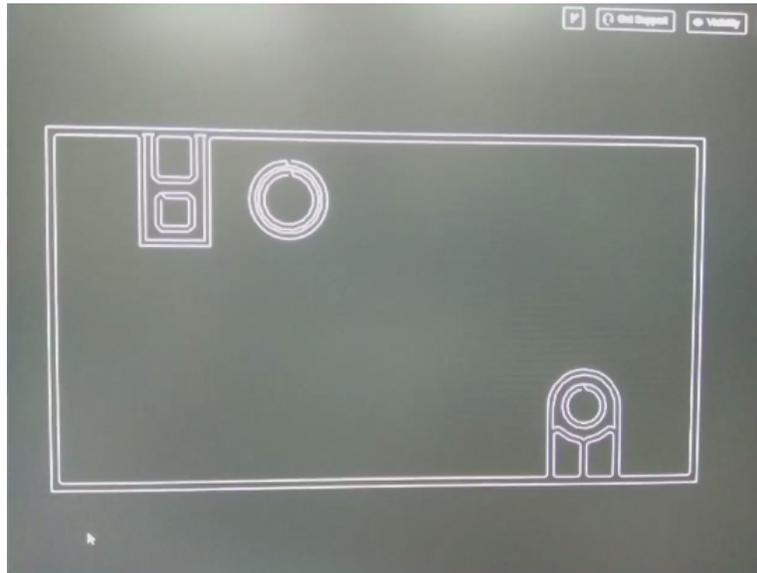
So what you see there is part of the honey comb structure which is being built up. So you saw the bottom layer then the in between to build up the thickness we have those layers.

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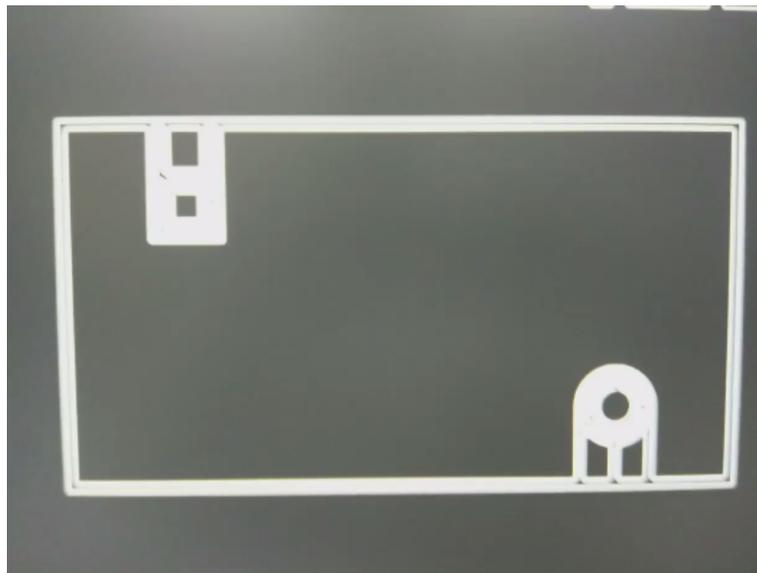
Next, you see what is happening? Already it is somewhat closed and 3 of the features we want are being built up and what you see there is probably the support material and anyway I am not very clear because when you go along I will explain to you how this goes here. The black stuff is the actual material remaining in the support material.

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You see here slowly as things keep building up this is almost towards the end.

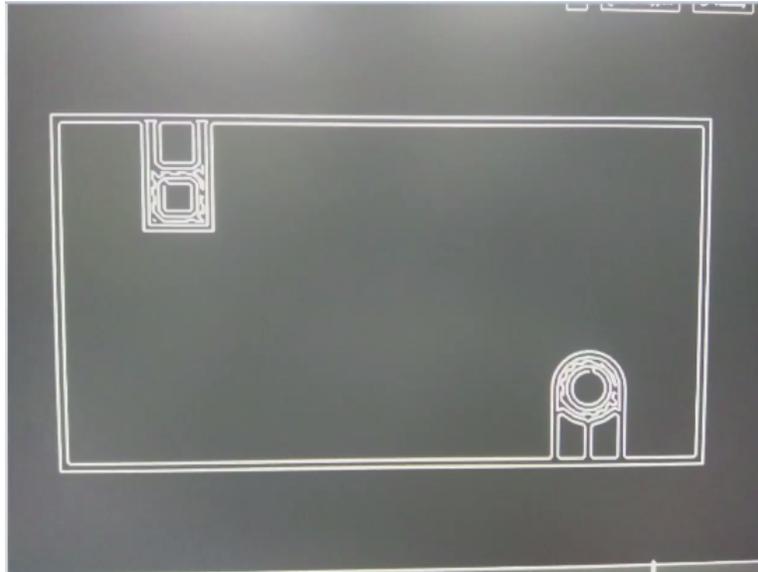
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This is the actually finally built material. This is all how the material flows, how the thing stays inside and you see here in fact it is a single filament which you know as much as possible they

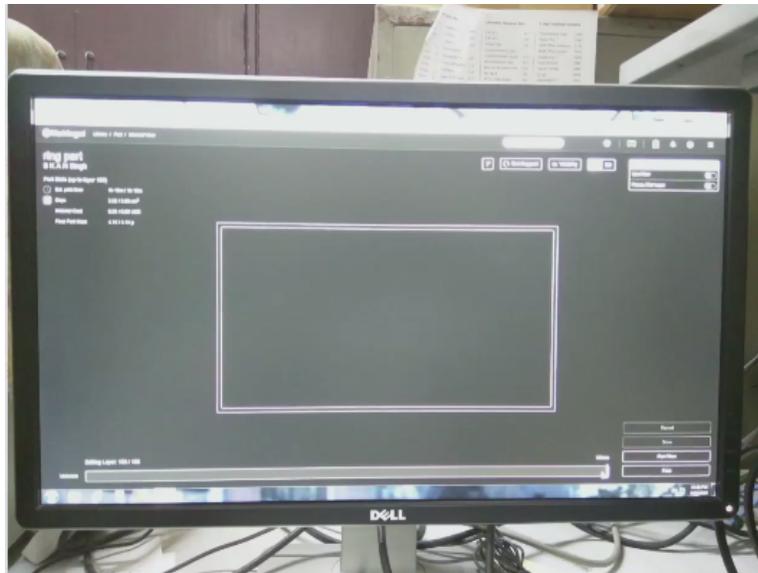
try to join together. And in the end you have a beautiful part which satisfies your condition. I hope this is the last one.

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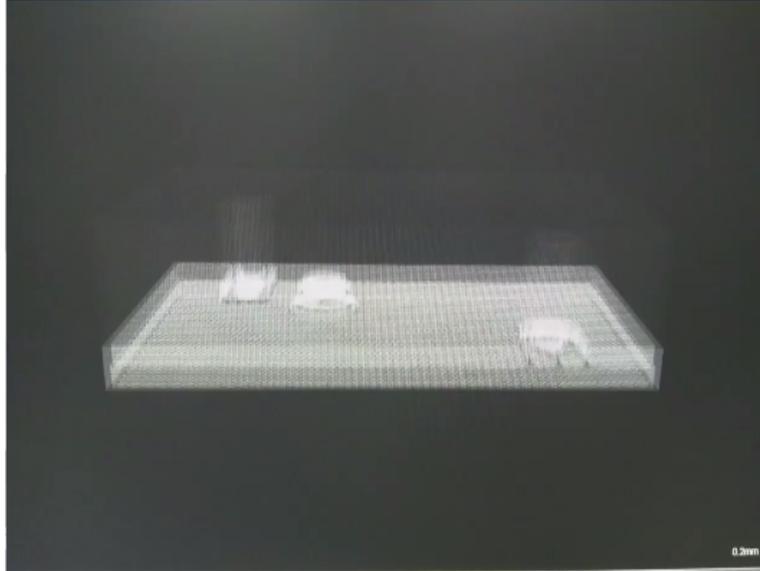
This is in between as things are being built up.

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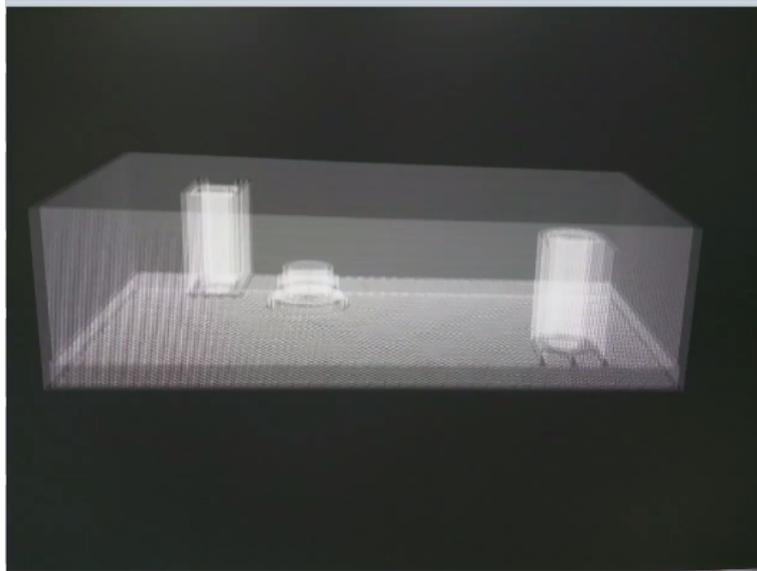
This is the final cover and we are done and the same thing.

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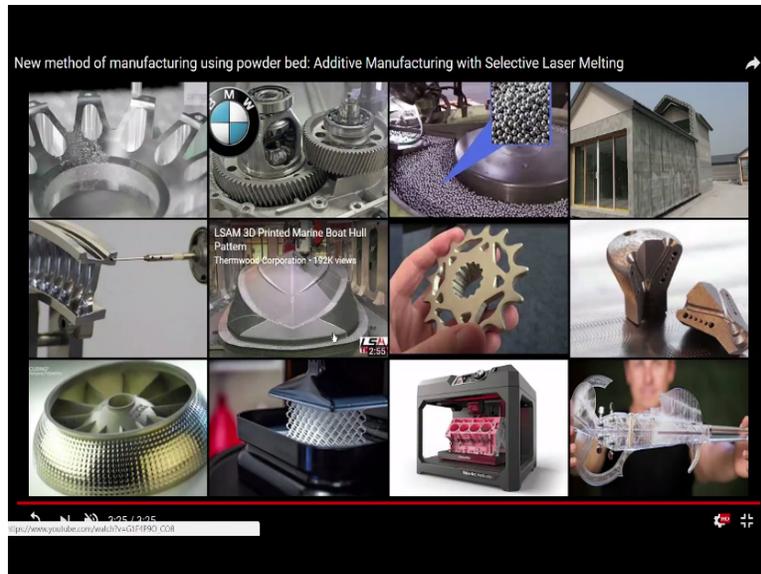
And in the inside if you see how these things build up and if there is any clash or anything that was a 2 dimensional from the top of the layers are built.

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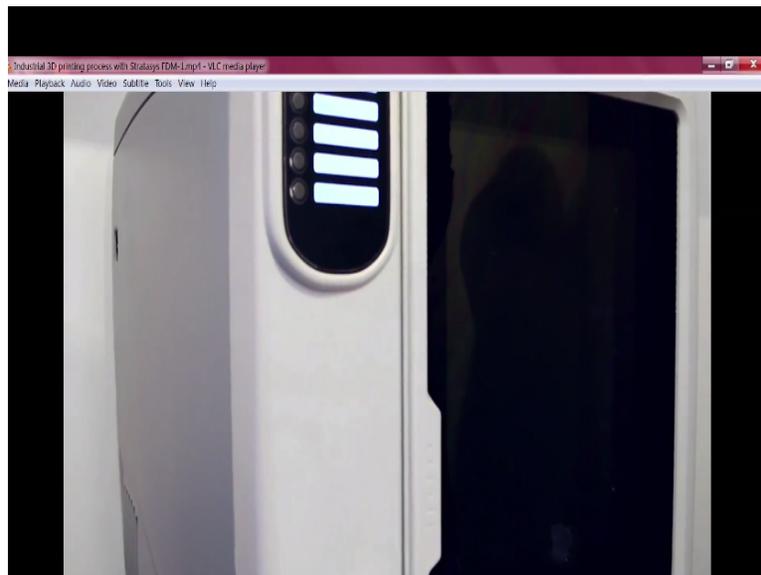


Instead this is a similar one what when made with 3 dimensional creations eventually this is what printing looks like. So I hope it has been reasonably what you call explanatory.

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If you come back to this main monitor you see here several types of I hope my video plays. There is a little problem in downloading the video I have not checked. Pardon me if it hangs. Yes, my computer does not seem to be able to. It is a very simple thing the object is a belt buckle. **(Refer Slide Time: 06:53)**



This machine we have will try to and some job is running I will see whether I can run the same thing for you and in this case in fact we have 2 materials 1 support material which is you know one type and then the actual building material so both are fed into the same nozzle and the nozzle goes around right now probably that support structure has been made as part of the built.

You can see thing as it being built up one of the things first thing you will notice is there is a z axis movement also and to clean it is going a little there is a small wire brush which comes and cleans up the corners. So we have a support structure and then in the top we have the actual buckle and in the case the material itself has a little springy properties where the design has been done it is very easy and the least amount of trouble had comes.

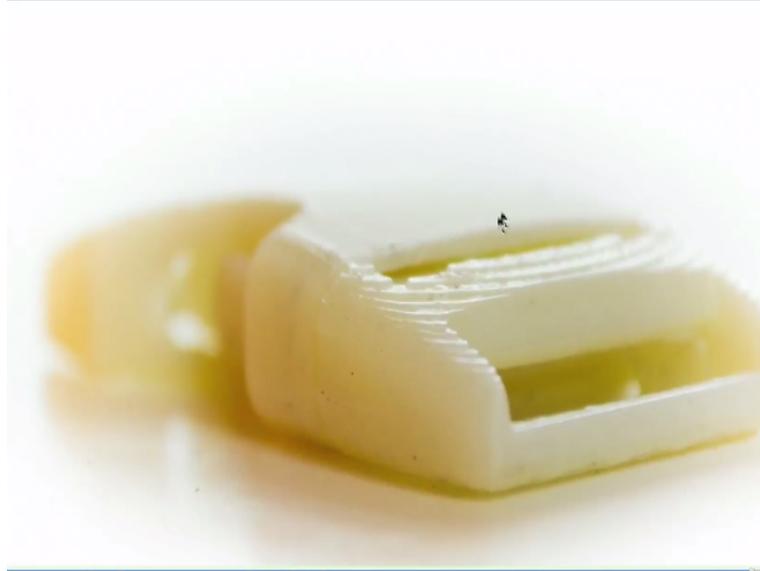
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Then you go and put it in the water based ultrasonic cleaning system nothing water and probably some minor chemicals are added little like a soap solution or something to reduce the up to the control the viscosity eventually I have a clean part which says as well as the regular part. So this is almost like a demonstration piece and if you can just sort of smoothen out the corners it goes in snaps itself extremely well strong enough also which is probably one of the nice things which you can do with a 3D printing machine.

So I think this is this should be illustrative enough for us seen here.

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What we need to observe is you see this small layers here contrary not contrary I keep repeating there is a what do you call fixed resolution and so on so if you want parts to look very near the original you have to give high resolution alternatively you can try to apply some other fillet material and send it off. So various types of the same thing what you are likely to use with metal called metal paste or any touch up compounds can be always used and afterwards by hand.

If you try to touch up these things by hand you can have products which are as good as the original but this is the real things normally this is about the resolution and the type of things that we can get. So little bit of search I could find it and I am happy to share it with you. No, not playing. This is the other bigger thing I have shown you instead I had recorded and I just though I will show you this.

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You have already seen it and then it is very much possible for you this is exactly how that you know handle has been made. This is about what we can see now if you go back here to the YouTube you will see very, very interesting parts including comparative statements between what are the different types of 3D machines which are available in the market and if you are one of those lucky people who have what you call very good this thing you see here those kids are playing with a bionic hand all printed at home.

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And there is a quadcopter printed at home and you have all sorts of even anything you want you can probably make it. The core thing about it is that filament have you push the filament into this secondly some objects like this you know car parts and all that the probably is nice understand

and how well you can build those things so one of those things I feel it is worth where it to see and write now it is not very expensive it is available in India also. All that happiness does not comes naturally. The seller is selling the happiness.

It keeps going on like this saying how to print a small object and so on, but when you come to technical objects the design is very important not many what you call designs are available. If you remember in the slide which I want to that first picture what I showed you lot of these things were so people go about and you know imaging things and may be you can attend conferences may be you can attend, try to make what best you can and these days is available as a service.

So all sort of you know objects can be created and you know you can show how these things something is nested in the thing and then how it rotates you can see there.

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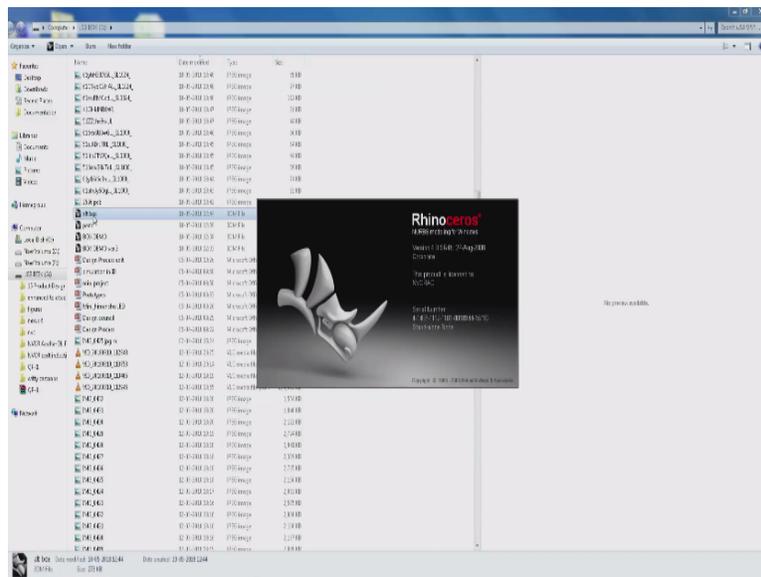


This was not possible at all once upon a time. A 3D gym ball gears are all interconnected. One drives the other and so on and then beautifully you have. So I suggest you see it at your leisure. I am sure very, very interesting things are there. This one I want to show you. Now whenever we do a small modification before actually firing the job we will make what is called the STL file. When you make the STL file the amount of time required for the job to be built.

And then the cost of the material and the weight of the materials is usually automatically calculated. Most of the time print time you see there the simplest box what you are talking about. It takes more than 1 hour it is a very tiny thing the size was 30 mm I am sorry it may be 40 mm x around 25 mm x 25 mm. It takes more than 1 hour to print and the overall volume and then the mass of the object is calculated there.

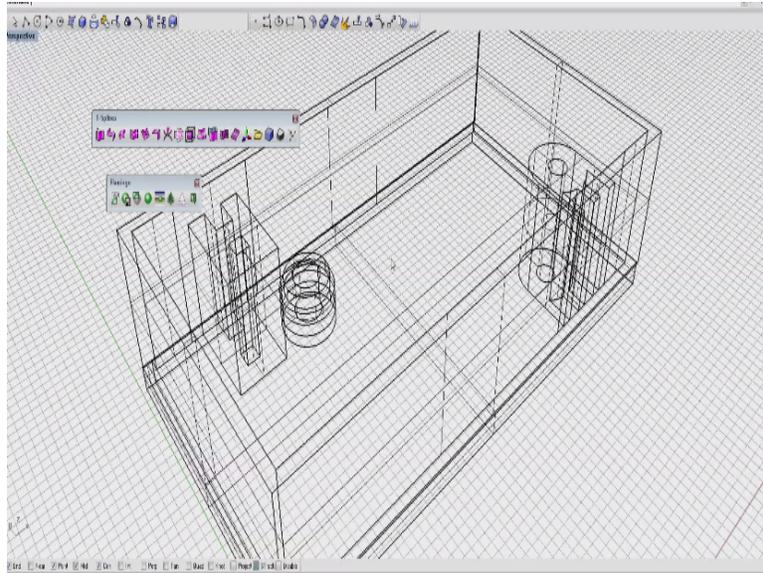
In some places it is not very critical and in some places you need to work on it and every alternate option you try you can easily see how the print time varies is a complicated thing it takes much longer and you have spherical or you know 3 dimensional affairs every time you can go there and make your own what you call things depending on the local affair. I will exit this and go back to my other computer where the 3D software is resting. I will try to open this.

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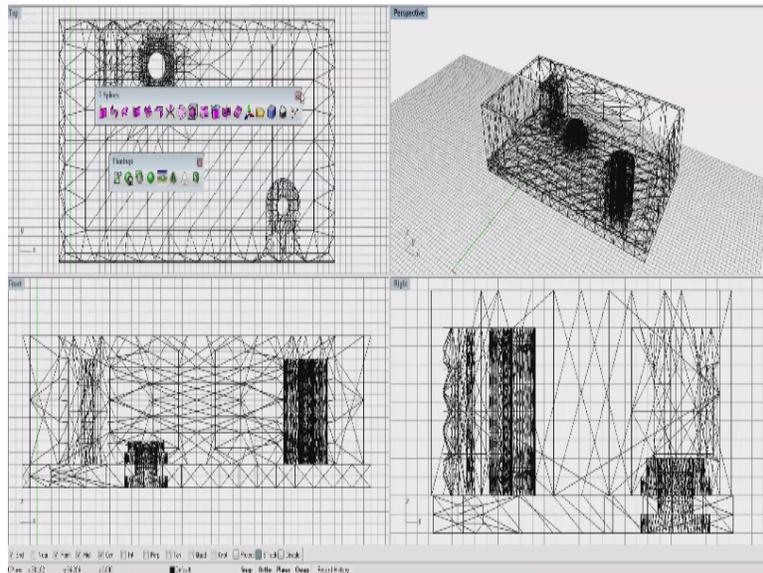
So if you see this, the part which had created and trying to showing you at the time. You see here I had showed all this and I will see whether, this is best.

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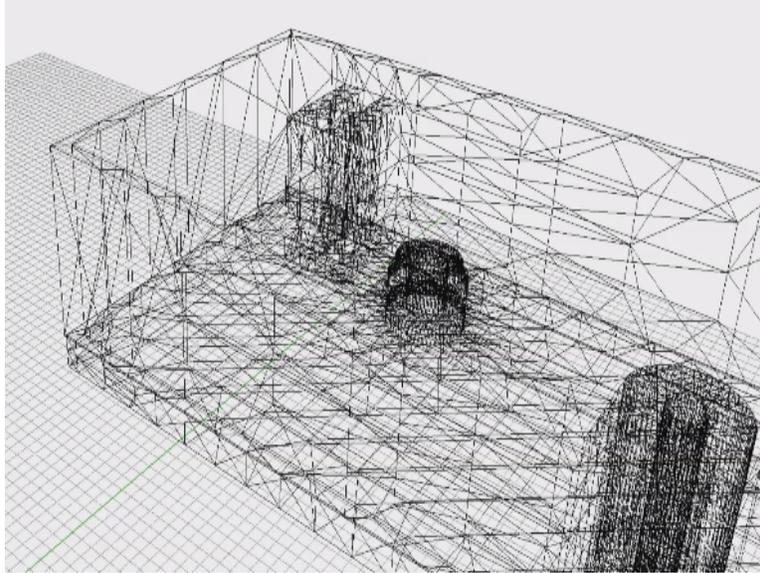
After having made this when we save this, this is where actually you know comes to the next part, but still I will try to show as best as we can. We end up with options here there are stereolithography files mesh part that has been made.

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Now if you see here that why lot of those circus was made was to see if this mesh can be simplified and how well it actually builds the parts.

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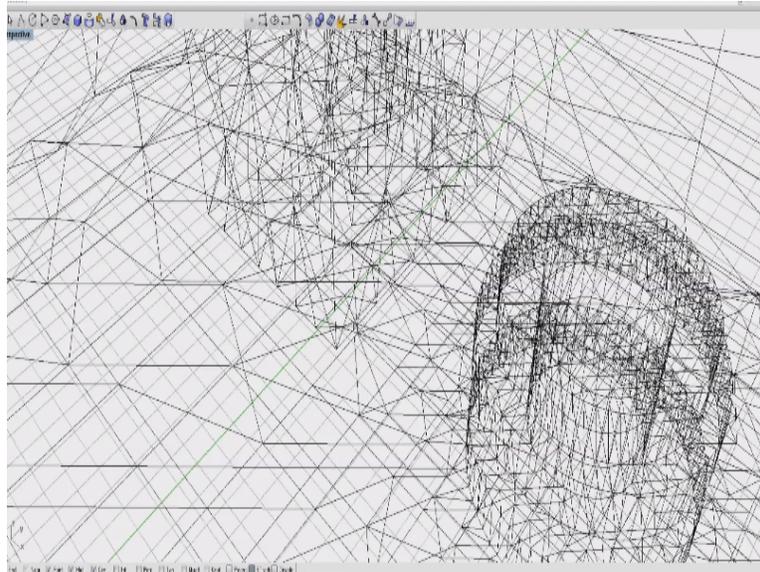
So in real life all 3D depends on mesh or some sort of the other. There is no other way making anything. You see here now I have 2 things while it looks simple. This what you call the other part while look simple the way the mesh has been generated the files will become bigger and bigger and actually if you take a very complicated part making this will be a really what you call it may be a challenge. It looks okay once the rendering has been made, but actually when you want to do the building.

I am not very sure how well the part will come to help us create in this mesh it is much easier to make things which are planar and if you look at the things this is typically a stereolithography file which all are spread. So if you have a planar or any plane what you see here in space 3 points only can be planar under all conditions. The moment you enter to a fourth point they need not be in 1 plane so if you have a square I mean what you call a rectangular plane like this you will notice all the 4 corners you have something.

We can always bend it like this the moment you bend it, it has become 2 square I mean 2 what you call triangles you have see this, this is typically one of those mesh triangles it looks a little like a sandwich and all surfaces all solids everything is build off those things like that only then we can make these things very, very practical and interesting. Only problem with this is the resolution. So resolution still is a problem and after having printed it you have to take it out and

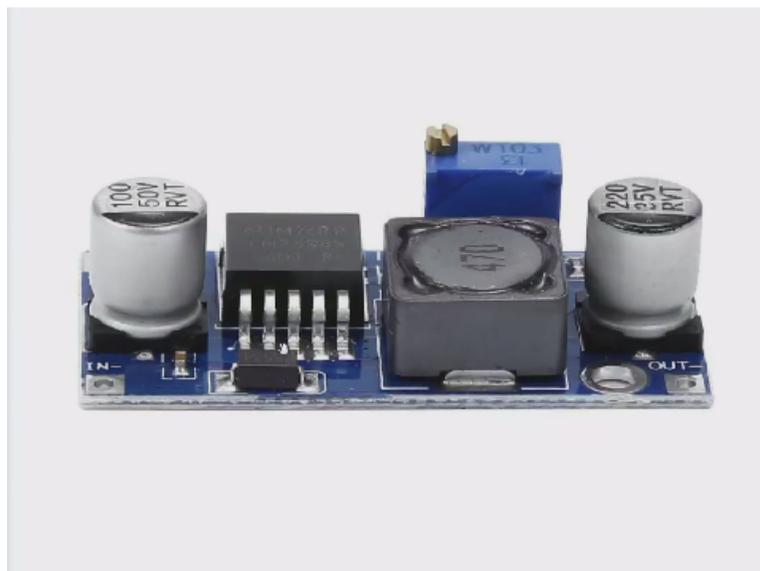
finish the objects. When you finish the objects I am sure the things will look better and better and better.

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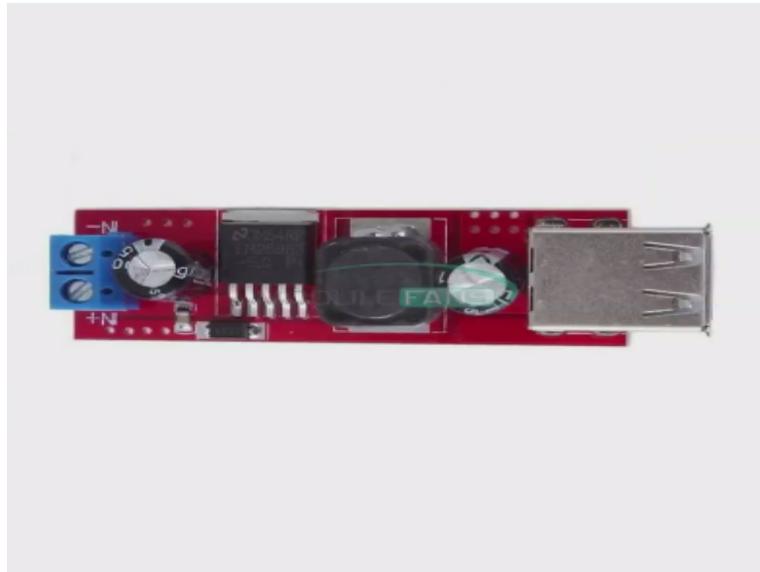
So you see here so with a little bit of practice probably you can start making things which are optimum. Well it looks easy while creating the drawing edges you just make a series of using 3D primitives like a cylinder and a prism and something eventually when you construct it we end up with files which keep getting bigger and bigger and bigger. And this particular surface file is required for you to build what you call any, any other intelligence including various types of drawings anything you want has to be made on this.

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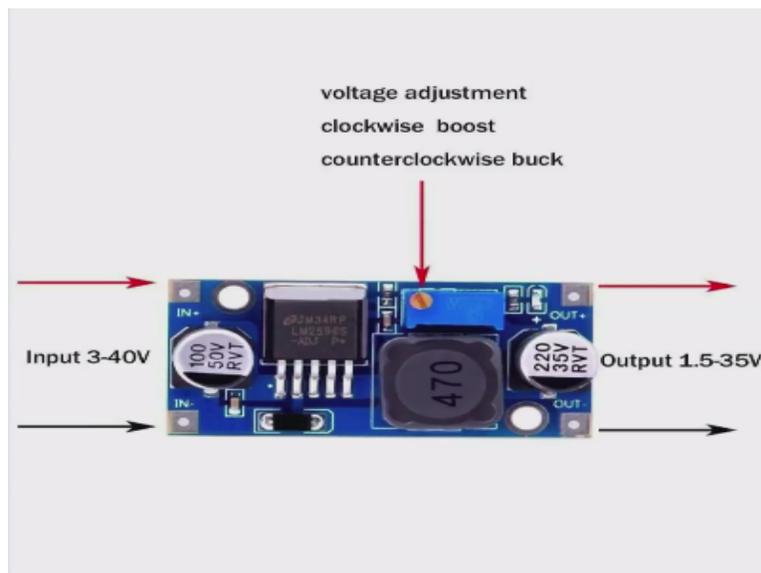
If I come back to this old printed circuit board in principle, I can create a 3D object here or I think I showed you yesterday I showed now 2 types of things were there same thing.

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See in that end it this look a little similar except this if you see the location of this what you call mounting hole. Mounting hole, you see with respect to what you all this and this and all the mounting hole is here. You go back to the other one. The mounting may be somewhere else.

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So it is you know you need to work about you know how to make those things compatible and things look very, very similar at 1 stage, but eventually they not compatible as it is. So for this what you call session I will stop here we will continue afterwards and I will see if it is possible

for me to take this small job and then get it what you call printed in our premises and get a video of the printing. So thank you I will stop here.