Physical Modelling for Electronics Enclosures Using Rapid Prototyping
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Lecture – 29
Product Clamp Built Up

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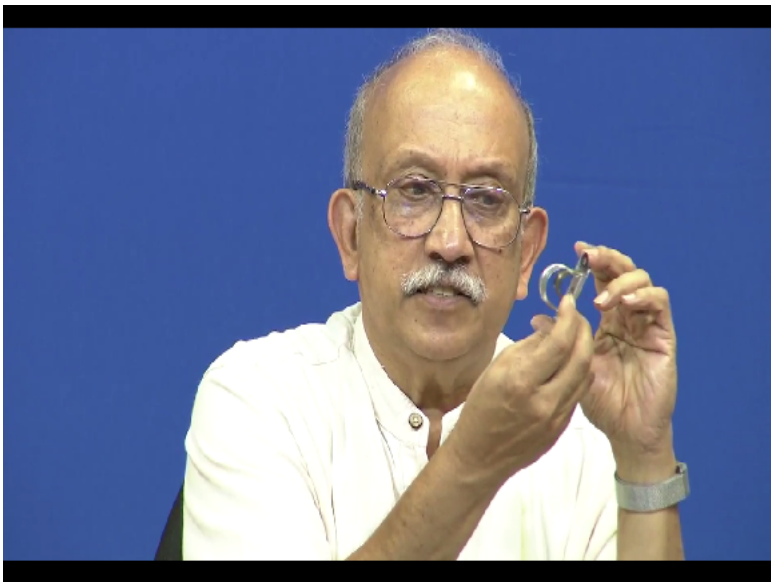

Now you will here I have told you because the thickness is very very small. The other sheet I have shown you is very thin. In fact, it is only 0.6 mm. This is slightly better, probably this is around 0.8 mm. Still we noticed that it needed to have stiffness, it needed these 2 dimples, additional operations. So in the machine shop or in the fabrication facility, when you want to make thing like this, you have a sheet which is running on to a, what do you call, on to a tool.

So depending on step-repeat type of things, you know, whether you make the punches here or whether you emboss it first and then you, what do you call, bend it into the shape wire. You have a tool with, when you feed the strip in 1 shot, it does this forming and then you probably need to, first you need to put a blank, put 2 pilot holes and then in the next stage, the whole thing is formed. Problem is the tools cost lot of, lot of money and nobody is ready to make any small changes in that.

Let us say you want 200 or 300 pieces, there is no way of making something which is just 200 or

300 pieces and we are lucky if all of them fit as miraculously as we want to. But if you go for a regular, what do you call, process industry, you will notice that this pipes and tubes of different diameters are on all over the place and it has become a field by itself to make these things. So now allow me to go back here.

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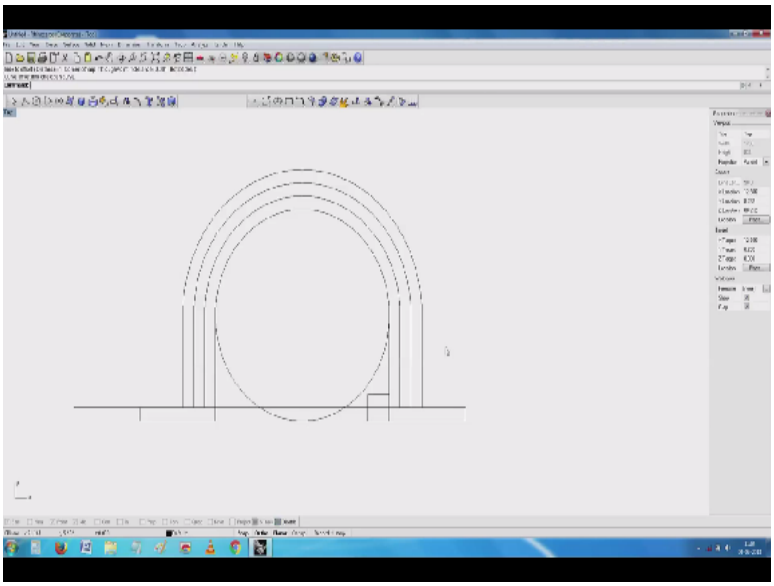

Is there a way of my trying to add strength to that? Obviously one of the obvious and simplest way is try to just make it, thicken it as it is which works out in most of the conditions. So thick. Now comes the point. So can I afford to have all of the space everywhere? And the moment I make it thick, you will see here I have some compromise here also. So how to get over it? So obviously 2 parts of it.

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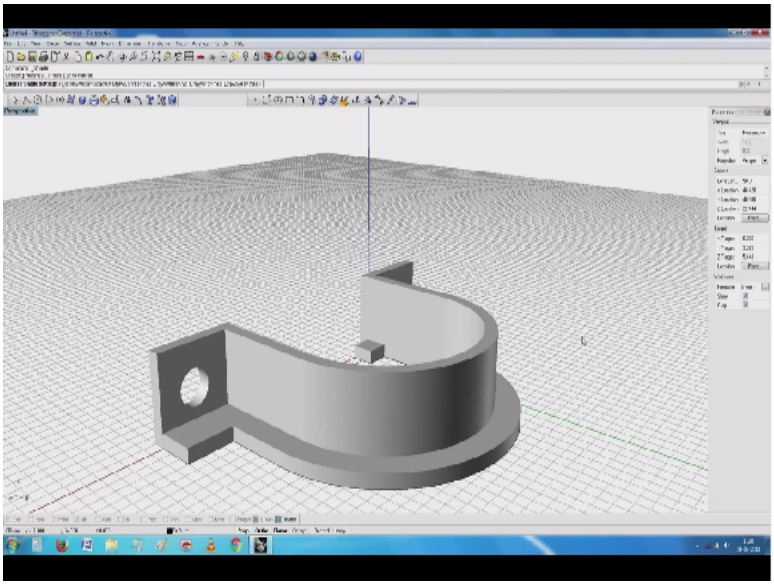

So around the circular part, I can build 2 small flanged objects. Center will not change. I have these 2 objects. So you will see if I can now make it using this here. See here I am taking the topmost. I have got a thick beautiful, what is obviously a flange which I can use without any problem. See here, something is happening. So I will now try to build this one more time. See here?

I have got something which is probably very very useful to me as a flange. So I will now try to attach only the wanted parts. See for example, I will take all this. I have got a beautiful flange like object here, just for the, what do you call, for understanding. Let me go here, let me take this and try to extrude it a little and see. See? Nice. I have not compromised anything here and I have this small projection here.

No, it will come to our interesting or whatever it is. Now how do we build this part?

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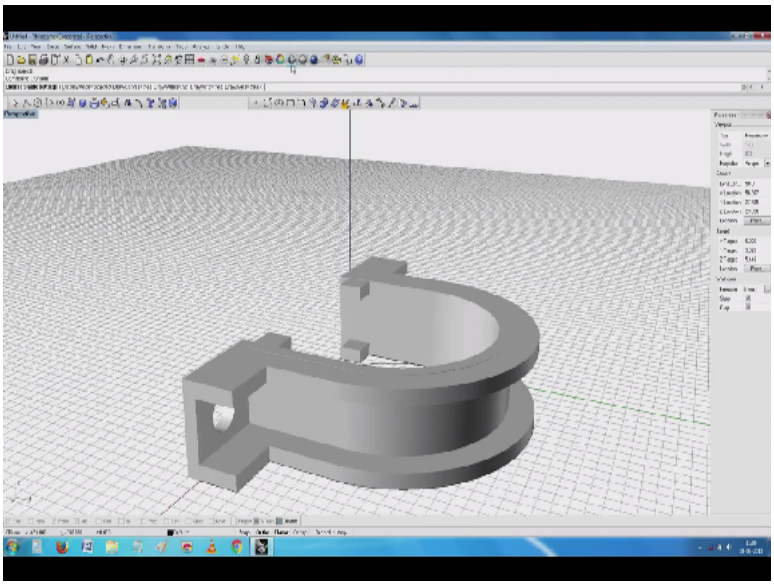

And I think in principle, it can be built without any problem because the machine will start laying up things on this side. I will admit it is probably an error. This small thing I need to correct it, this one. That was the inside, the outside part. Now I will just copy it, move it up. See here, I have a beautiful object that can be created.

Now comes the thing saying should I leave it here, should I make it into a long piece and does it have any function? It is likely one of the other advantages is, it can be built easily. When the nozzle is trying to lay up, it will first start with this thin section. After that, it will fill this and then go up. Now comes the other thing, should we built the whole thing in one thickness or in case we build the thickness, what will happen here?

They are the things that we need to work. Now I will prefer, in fact, not to build the full thickness. It has certain advantages because on that now I can do something. Except I will try to reduce the thickness here. So I will have a full thickness here. I will make a small, what do you call, depression which is otherwise in mechanical which is called a counterbore. I can make a counterbore which has slightly shorter than the screw height.

So if a standard cheese head screw, generally the overall diameter is around twice the nominal diameter. So if I am using a 4 mm screw here, I will have 8 mm and the height also will typically be 4 mm. So I will make a counterbore which is only 3 mm. So with this, this job can be easily

produced. Now the other thing comes about saying do we save material or do we save built time or anything? And the amount of, what do you call, various other operations.

No if I try to just make this part, you see here, it looks nice absolutely. The corners are sharp and by all other means, absolutely no issue of making a part like this. So in case I want to make a full; this is same piece, absolutely no problem at all. Now if you come back to the old, this thing saying I was telling we need a, the same hole to be continued to the other side, we need a counterbore.

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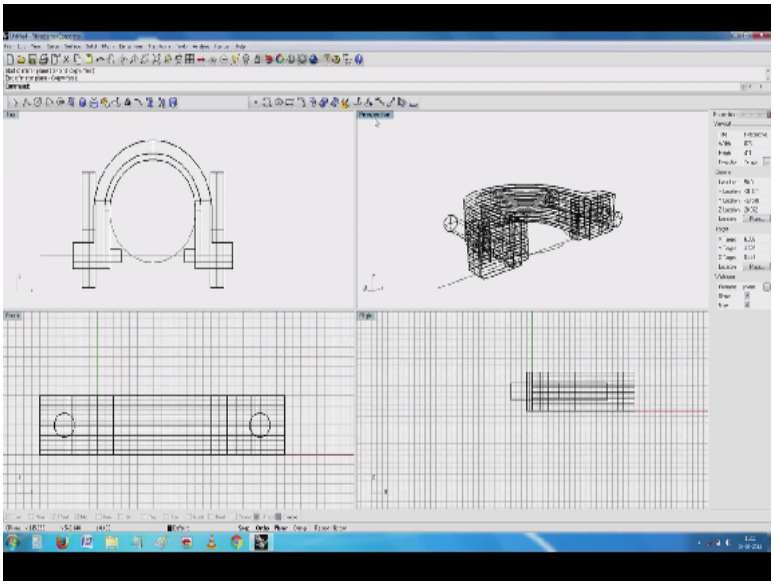

So to build the counterbore, I can continue to use the, this opening which is available here and then try to see. I hope you are a little with me. I will just see how to make a counterbore.

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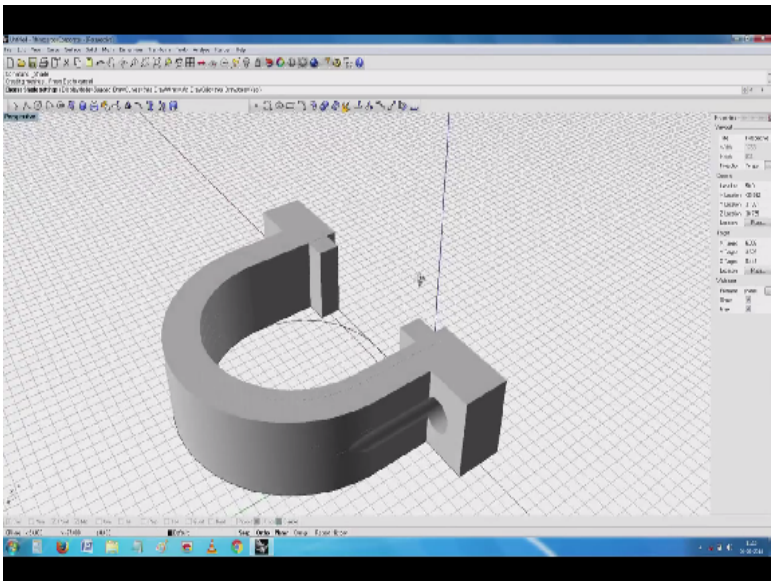

This is the basic opening which needed to be made. Now you notice one of the thing about the advantage of doing things in the, this technique of solid modelling is, without too much effort, I already got this.

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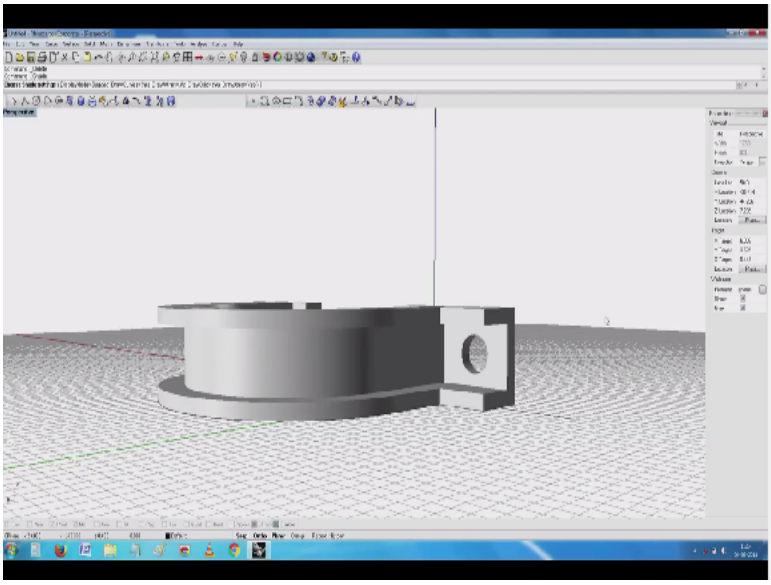

Now I need to take a call on what should be the counterbore which I make? Should the counterbore be done here or because of this thickness and to have the screw head to sit here, do you think I should extend this? Now you see filling it up, while it did make sense at one level, at one level, you will see that, you know, there is need to be a little compromise about it. That is the reason why probably this design was marginally better.

Because now you see the thing can sit there and functionally it is about the same and if I want, I can leave it as it is or try to close this at all. Now printing things like this is not impossible. I can now, what do you call, export this object that to the printer and next round when we do a trial run, I can show you how it prints. Now you will see that; so if you remember, I was here last and then let me see if something can be done and made this into a proper object.

I see that it makes sense if you can put a small, what do you call, extra, small rib here. So building a rib is relatively easy.

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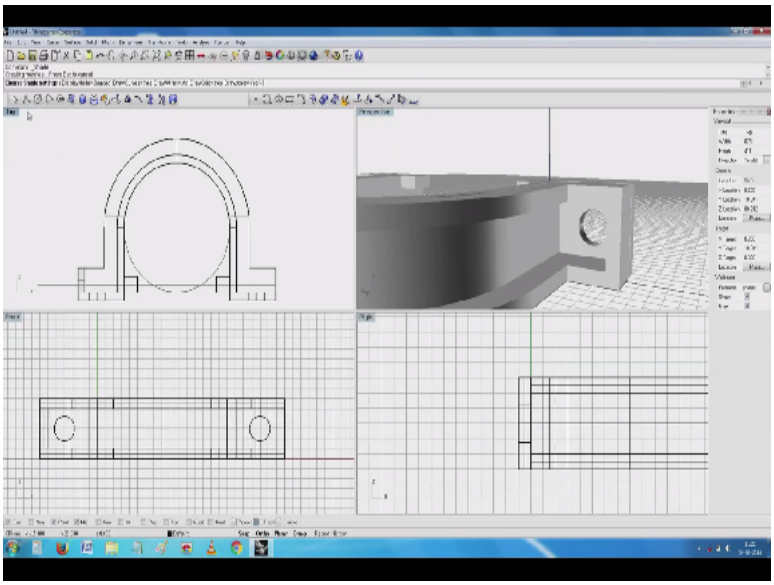

I will start with making a surface with corner to corner. See here, a small surface has been created and I will now extrude the surface. See here. What I wanted has now come without any problem, except that I know I did a goof up. So allow me to start again, try to make the surface again. This is slightly better, this thing. So this solid is going to be, see here. I have a neat box like structure.

And I can probably introduce a standard screw or in this case, it makes sense to have a pozi 4 or pozi-drive headed screw which should snugly inside and if there is sufficient thickness here, it will not get crushed as an object and secondly, it can be printed extremely well. See here. It is a reasonably completed object and I have avoided trying to build a counterbore which I was talking to you about and overall, it is compact compared to the original width.

This is the width of the tube and then width in this maximum, whatever it is, I have the object.

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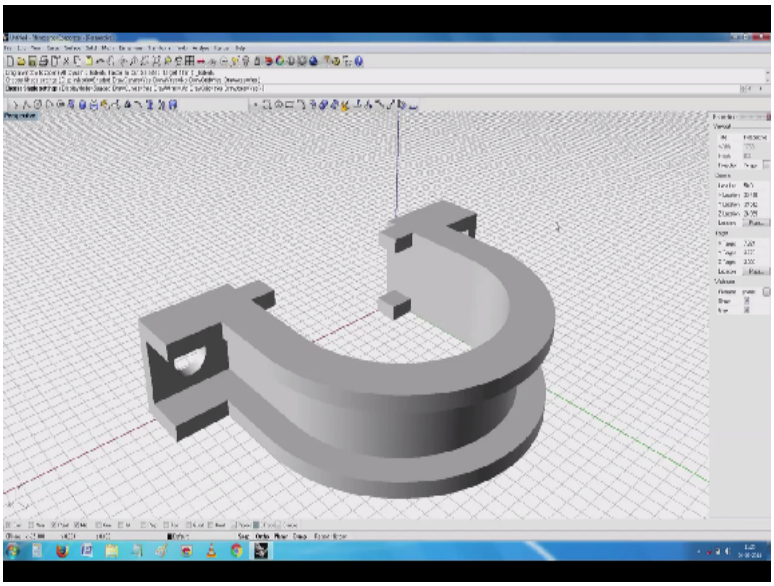

Secondly, it is very much possible for me to estimate the total volume of this. So I select all the, hide all the unwanted objects and build everything together in one lot. See, I have a neatly builded object and best thing is, I can go here and check the, in the analysis point of it, I can go to volume. I see that it is 596 or approximately 600 cubic millimeters. So which will come to around 0.6, what do you call, cubic centimeters and, coming, corresponding of that weight and all, we can have and we can make a neat cute object.

So, yes. Oh, I am sorry. A 1000 exactly, you know. So I will have something which is approximately 0.6, what do you call, cc which is actually quite a compact object. It will not going to cost me much and now with the latest things like our glass filled or nylon other, you know, what do you call, filled objects, we can have a thing which is absolutely, it is a wonder to make. Eventually, this is how the object is going to sit.

Now one of the, what do you call, I will say the plus point is, without actually incurring too much of extra cost, it is possible for me to build a large number of them. You understand?

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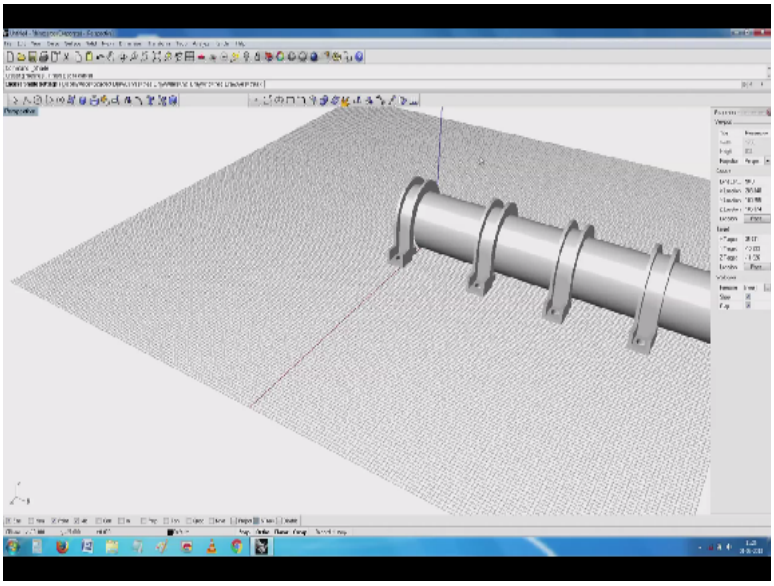

And now next is when we need to erect these objects? See, I have 1 object here. I need to show a large number of them. I can in fact, make some arrangement by which I can space them automatically. These 2 small limbs I have put here, I can make some spacing device and have a tube run through this. You see here I will see what best I can do here.

See 3 of these what are obviously clamps, now we come to the next important thing saying, let us say I need to make a corner elbow or a corner bend. Is there a way of my making it. Right now this object is only as good as just making, I will start with a simple cylinder because that is, you know, life is easiest with; see here. Looks cute. Is it not? Now we come to the next important point.

Probably I will convert. I mean, I will make it in the next class. Let us say you have this tubing and for some, your good luck or bad luck or anything, you need to make an elbow and with standard things like this, is it possible for us to build an elbow which takes any other direction we want. Traditionally in plumbing, what do we do?

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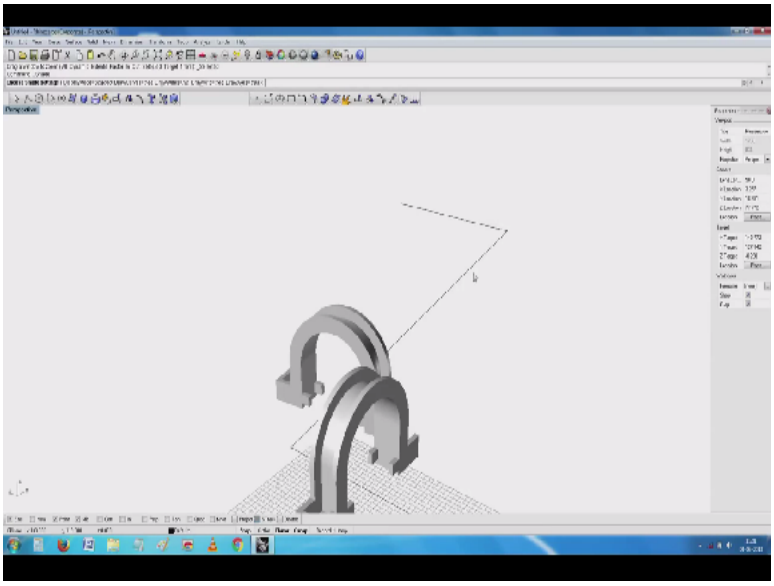

Traditionally in plumbing, we make things like; we take things only like this. Now while it makes sense in a lot of thing when we are having pressurized system. Imagine you have a gravity effect, what do you call, piping system which can typically, it needs to have a small inclination here. You understand?

So let me, I need to have an inclination or a draft so that water will flow easily. Now when you make it, if you were to use a standard elbow in this corner, this elbow is 90 degrees or you can get 75 degree elbows. And if you want only a small thing like this, this corners and all are best built by our object here. So what I do? Can I make an elbow which directly is also made into a single piece? See here.

This is where our thing makes a lot of interesting thing. It is possible for me to just bend it here like this and build a whole tubing and piping system which; see here. I have an interesting object. It is possible for me to make a pipe which follows this and in fact, since it is symmetrical, I can have the pipe, one part of the pipe here and one part of the pipe here, make a bend, make a convenient smooth bend.

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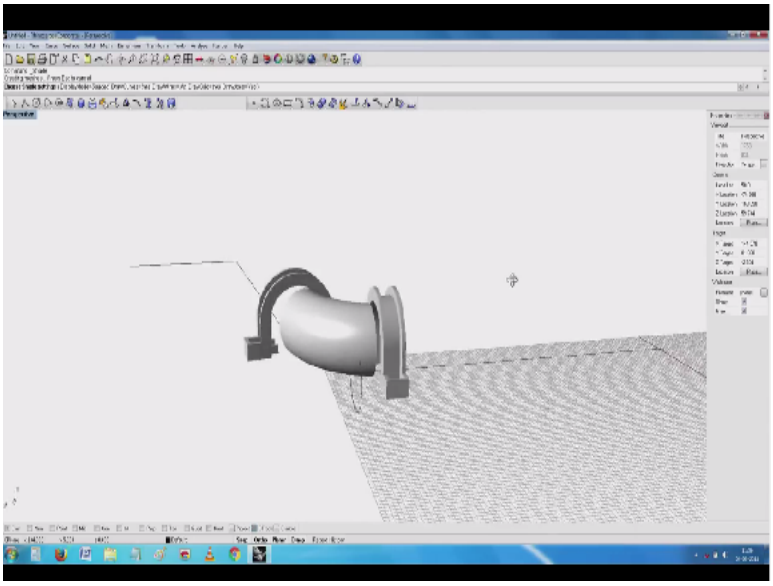

And I will see whether, how well I can create it here. Can you see here? I have something here. I have something here. Now I will see whether I can fillet this line. Something is happening. All I need to do, do is, take this. Now see if I can make a tube which follows this and have another coupler on both of the directions. So I will just try. So far I have not tried because I am trying it on the fly. Please see how best, you know, you can be with me. See here where I am.

That circular, that pipe object has to now be moved, taking the center to the end point. Pick both of them up and try to now extrude this along this. I create a surface by sweeping one rail. There is a cross-section curve. No sorry, it did not happen. All I need to move it in the correct position. See here, slowly, my thing is; at least I am trying to make it. I will have to practice it. See, the object what I wanted to create is slowly getting done.

So if I now make a, what do you call, a union or a nipple or something which I can go and engage it into the other one, this whole assembly what I have shown here can be printed in one place. So once again we come to the thing, advantage here is being when you are in plumbing, you have to do it on site. So we have no option but to use such tricks and trades. So I will stop here and give you a little bit of practice. So I will continue in the next lecture. So thank you.