Engineering Graphics and Design
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Lecture 23
Week: 5 Auxiliary and Section views
W5 L2 Sectioning practices

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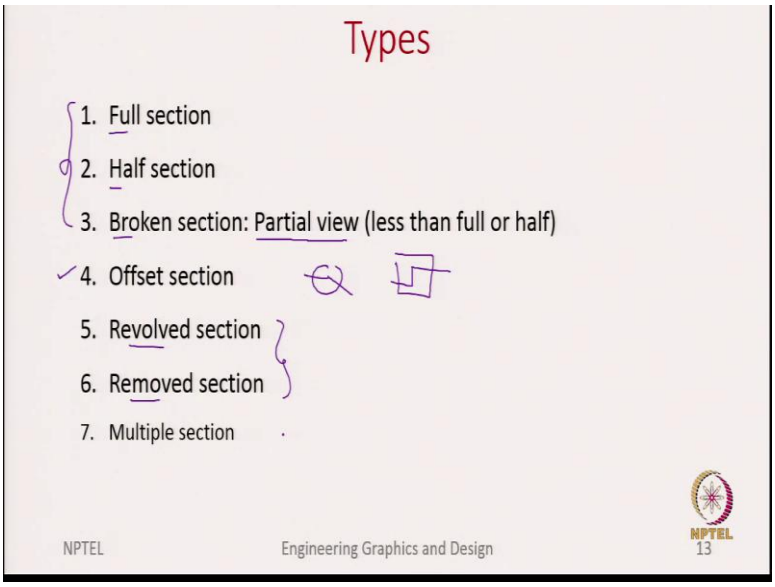

Having learnt about all the section views and also different kinds of section views, what is more important is to know the practices which are really used. Because at the end of the day we want to draw this on paper. So, once you are starting to draw in the paper there are some common practices people use, such that, when you are drawing the section views and someone else is reading it, you and he interpret in the same manner. So, we will quickly look at those common practices, which are very useful when you are conveying information.

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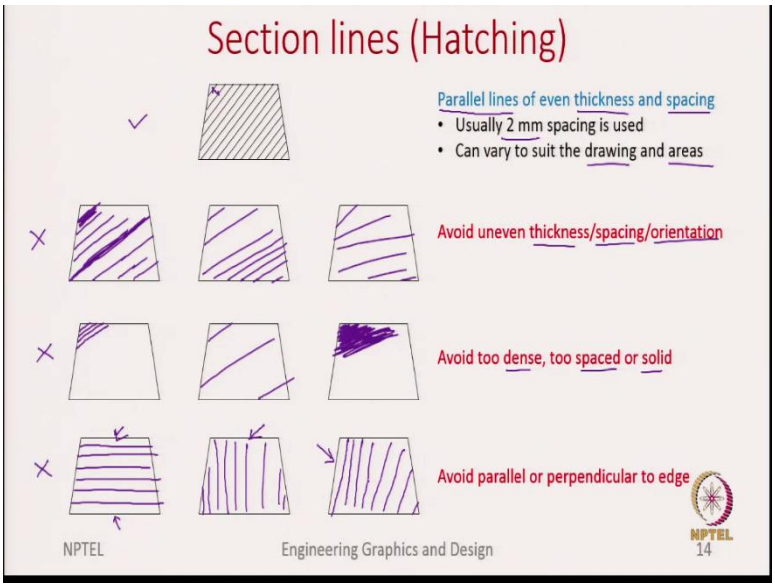

First, we start by this section lines. These are also sometimes called as hatchings. So, how do we draw these section lines? So, I said, we draw them as parallel lines. We also say that, you need to maintain the even thickness, which means, all these lines should have the same thickness. Not just the thickness, even the spacing should be uniform. So, this spacing between these two lines should be the same throughout the section area.

And now the question is, how much space should I leave between these parallel lines? Usually, people use 2 millimeters, but it is not hard and fast rule. It depends on the kind of drawing you are drawing. Are you drawing it on a small sheet of paper or a big sheet of paper. It also depends on the object. Are you depicting a smaller object or a bigger object.

Because you cannot follow the same 2 mm for A4 sheet as well as for a bigger things like A3, A2 and A1 sheets. Because then, I mean, you will spend the whole time just to draw the parallel lines, because 2 mm might be too small if you are drawing it on a bigger sheet of paper. Then what you need is, probably you can, you are free to increase the spacing between the lines. But let us say you are now drawing it on a A4 sheet or an A5 sheet which is smaller than A4, then maybe you may think about reducing the distance between these lines.

Maybe you can go less than this 2 mm. But again, you also need to keep in mind this, you do not want to keep the lines very close. The reason is, after you draw maybe people reproduce these drawings, which means they make copies. And you should think the limitations of the copy. Sometimes if you draw these lines closer together, during the copying, it comes out to be like one solid black color. So, you need to give enough spacing, not just looking at the drawing size as well as the areas, but also about how you will reproduce these drawings. So,

this is one correct way of showing the drawing. Just to illustrate, I will be showing you some common mistakes people do.

So first, let us say, we need to avoid uneven thickness. So, when I am drawing so that let us say for one, I am drawing a very thick line, the others are like thin lines. So, this is wrong. I cannot have one line which is thick, and the other lines which are thin. And the other way of doing a mistake is spacing.

So, you cannot have large spacing initially, and then come to narrow spacing. So, this is also wrong, because the spacing needs to be uniform. And lastly, the orientation. All these lines should be parallel. You cannot have one lines going in this fashion and after a while you change the orientation, all these are wrong. And similarly, we need to avoid too dense or too spaced.

So too dense meaning you cannot have them very close to each other, such that, I previously told you. If they are too close to each other, when you reproduce, let us say if you make copies of your drawing, it may not come as parallel lines it will simply come as some solid black color drawing.

And then having too big of a gap is also to be avoided. Because then sometimes you may confuse it as outlines of the drawing. And lastly, solid is also should be avoided, which means, you cannot simply fill it with one uniform color. So, these are all again, poor practices which needs to be avoided.

And lastly, avoid parallel lines or perpendicular lines to the edge. So, for example, let us say if I do this, this is a poor practice. The reason is because these section lines are parallel to this edge and this edge. Similarly, even drawing them vertical lines. This is also poor practice. The reason is because now again this section lines are perpendicular to the edge. And let us say, if I say like okay, I will draw it incline, but now I make it parallel to one of the edge.

So, now what is happening is, these section lines are parallel to this edge. Even this is poor practice. So, the best thing is, you need to ensure that the section lines you are choosing are neither parallel nor perpendicular to any of the edges. So, now let us look at few more practices. Because as we go into the real world, we will be faced with different kinds of objects. There are some objects we do not even section. So, let us look at those kinds of examples too.

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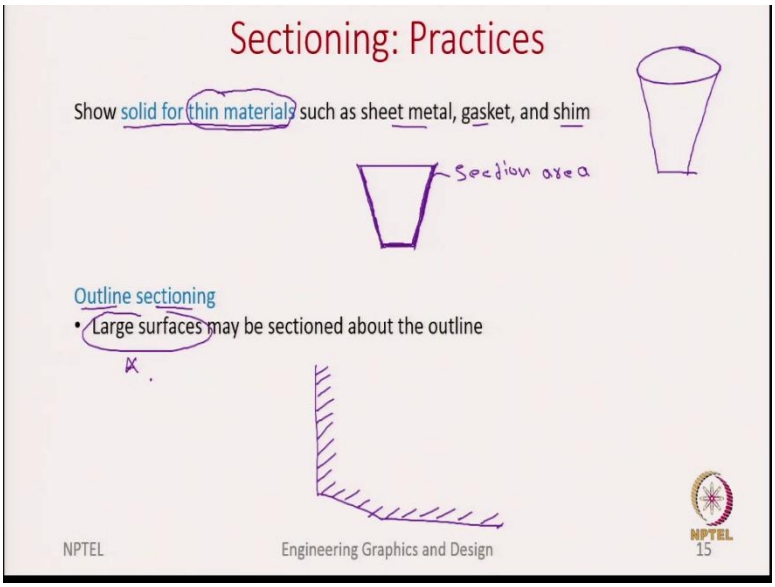

So, we are saying that shows solid for thin materials. Such as, sheet metal, gaskets and shims. So, let us say a glass, let us say. So, any regular glass, usually it is made up of sheet metal. So, if you have a section, it will look like something like this. Since, it is a thin sheet, you may want to show the thickness of it.

Now, we have made the section, and there is a section area. So, for example, this is the section area. So, if I go ahead and draw those parallel lines for sections, I can still do that, but it will be very difficult to notice. So, for that reason, what we are saying is we can go ahead and do the solid, so which means you can just fill it with solid color.

But please note, this is only for thin materials, not for regular objects. The reason why we are going into solid coloring is, so that, even if you use those parallel lines, it will be very hard to read those parallel lines. So instead, we will simply use solid color. So, there is another section called outline sectioning, especially, for very large surfaces.

So, let us say, there is a one very large surface which needs to be sectioned. So, instead of spending too much time into drawing parallel lines, for the complete surface, they say you can only section the outline, so which means on the boundary you show the sections, and that is sufficient.

So, mind again, this is only for large surfaces. So, as you can see, these are some common sense principles, essentially making sure that you do not spend too much time in just doing this hatching, as well as, you should also be good enough, this practice should be good

enough such that when you look at a drawing you identify that so and so is the section area because that is also important.

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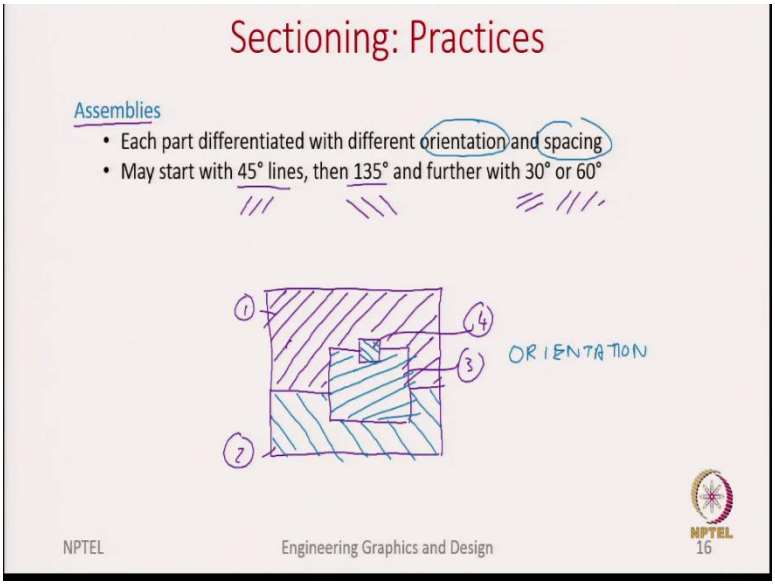

For assemblies again, we have a certain set of rules saying that. Because let us say two or three components are coming together, and then when you section, in that section area you will see multiple components. So how do you differentiate between component 1 and component 2?

You can differentiate by changing the orientation of these lines. So, here are some guidelines saying that maybe you can start with 45 degrees lines. And then for a second component, maybe you will use 135 degrees lines. And if there are even more sections, then you can use different angles. Let us look at with an example.

Let us say after I section, I see four different pieces in it. Essentially, let us say this is component 1, component 2. This is component 3 and this little box is the component 4. So, we have four components and then these four components what I am showing here is seen at the sectioned area. So, how do we show the hatching?

So, the guideline is, for the larger area, you can pick the 45 degrees lines. Maybe, let me change the color. So, the second largest area, we can now pick the 135 degrees lines. And the third largest area maybe now we can go into this 30 degrees lines, and lastly. So, what we are trying to say is, if you have multiple components, we need to change either the orientation or the spacing.

In this example, we only showed variation with orientation. But I could have also varied the spacing between the lines such that now you can contrast between two different components that also can be done.

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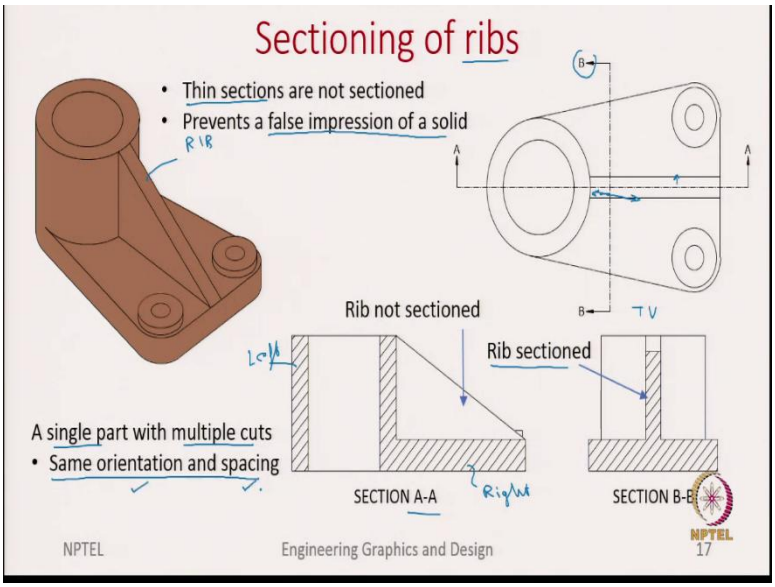

So, here is a special case about how do we section ribs? First of all, maybe not all of you know what is a rib, rib is something like this. So, it is a structural element, which is used to give some strength to the remaining structure. You might have seen these ribs especially for the poles. So, if you look at any lamp pole, at the bottom of the pole, you will see these ribs at four corners or three corners, because they give rigidity to the pole.

So, it prevents it from bending into one of those directions. So, as you can notice this rib is a thin section. So, it is a thin section, but let us say now your sectioning plane or the cutting plane is passing through this thin section. Should we really show the hatching or not is the question. The principle is saying that to prevent the false impression of an object, we should not show it with hatching.

What it means is, so when you show hatching, you get an impression that there is a solid object there. But since this is a thin object, we do not want to confuse the readers. So, in order to avoid that confusion, what we do is, we simply show this object as though it is not section. We show the rib but we do not show the section. So, let me show you how it is done.

So here is the top view. I will be showing you that rib in two different sections Section A-A and B-B. So, what is Section A-A doing? It is passing through the rib. According to the practice what we are saying though it is passing through the rib, we do not show the section.

So, here is the section view A-A and here I am pointing out to the rib where as you can see, we are not showing the hatchings. As I already told you, the reason why we do not show the hatchings is because once I show the hatching you have a feeling that there is a solid object, which means a thick object we are cutting through.

Since we are not cutting through a thick object, but instead for a very thin rib, we do not want to confuse the readers, and that is the reason why we avoid hatching for the rib. But here is the catch. So now, let us see the section B-B where we are cutting the rib, but this time we are not cutting it in a thin fashion. So, which means, we are not cutting by the cross section of the rib, but at a different section.

But here you notice that you show the rib as section. The reason why you show the rib as sectioned is because there is a lot much of thickness there front and behind the direction cutline B-B. So, if you look at the cut line B-B, the place where it cuts the rib there is a lot of material behind it. But if you look at this Section A-A the thickness of the material is very less. So, after the section, the thickness of the material is very less. So, that is the reason why we want to avoid the confusion.

I have one more important point, which is not related to the ribs, but it talks about a single part with multiple cuts. So, for example, this Section A-A you can see that you have this hatching lines to the left and the hatching lines to the right. Do they both belong to the same part? The answer is, yes. So, if they belong to the same part, but they are separated by some space.

So, because this left sectioned area in the right sectioned area, they are not connected, they are a little apart. So, here is the important point, we need to maintain the same orientation and the spacing. So, this angle, if it is 45 in the right sectioned area, even in the left sectioned area, you should maintain the same angle as 45. Same with the spacing.

The reason is, so that it will be easy for the reader. So, if the reader looks at to the left and right the same orientation and same spacing, he knows both are from the same part. But if you let us say change the orientation then he thinks maybe this is from a different part and the right section area is a different part. So, to avoid these confusions, we ensure that the same orientation as well as the spacing is maintained.

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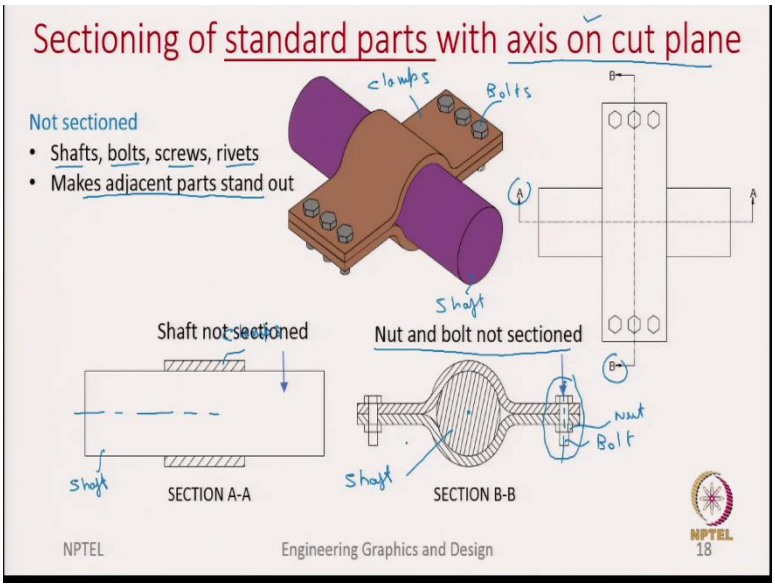

So, we are coming to the end of the lecture. Here now we are discussing about what we do with standard parts. What are standard parts? Standard parts are like off the shelf components. Like shafts, bolts, screws, and rivets. So, these are very common components in practice. So, do we really need to show the features of these when we are doing the sectioning is the question. The key part is, when you are sectioning the standard part and the axis of this part falls in the cutting plane. So, for example, let us see here.

So, when we look at this component we have multiple parts. We have this shaft, so these are the bolts and these are let us say clamps. So, what are these two clamps? You may have clamp 1 at the top and clamp 2 at the bottom they are holding a shaft which is passing between them. And how are you holding these clamps? Using these bolts. Now let us look at the top view where we show two sections, sections A-A and sections B-B. Does this cutting line for Section A-A does it pass through the axis of the shaft? Yes.

So, it meets this criteria. So, when it meets these criteria, that is when we don't show the hatchings. The reason why we do not show the hatching is, therefore, it ensures or makes sure that the adjacent parts stand out. So, since these are standard parts, we are not interested more in these standard parts because most people already know about them, but what we want to convey, the information we want to convey is about the adjacent parts which are not so common.

So, we want to make sure that those parts stand out in the drawing, and these standard parts need not stand out because we already know more about them. So, now, let us look at Section

A-A. As you can see, the hatching is only done for hatches or clamps. The hatching is not done for the shaft.

The reason why it is not done is, the axis of the shaft falls on the cutting plane. So, first of all shaft is a standard pace, and the axis of the shaft falls on the cutting plane, so that is the reason, why we do not show the hatching further shaft. Now let us look at another section, Section B-B. So, as you can see the Section B-B cuts these bolt and also the shaft.

So, first let us look at these bolts. So, as you can see the nuts and bolts are not sectioned. So, this is where we have the bolt, and the nut. Those are not sectioned. The reason is again the axis of this bolt and nut fall on the cutting plane. But surprisingly you will now see that the shaft is hatched. And the reason is again, going back to whether the axis of the shaft is it on the cutting plane or not.

The axis of the shaft is perpendicular to the cutting plane, so it does not meet the requirement that is why we show the shaft with hatching. And, of course, we show the hatchings also for the clamps. I hope, this clarifies when to show the standard parts in hatching and when not to show the standard parts in hatching.

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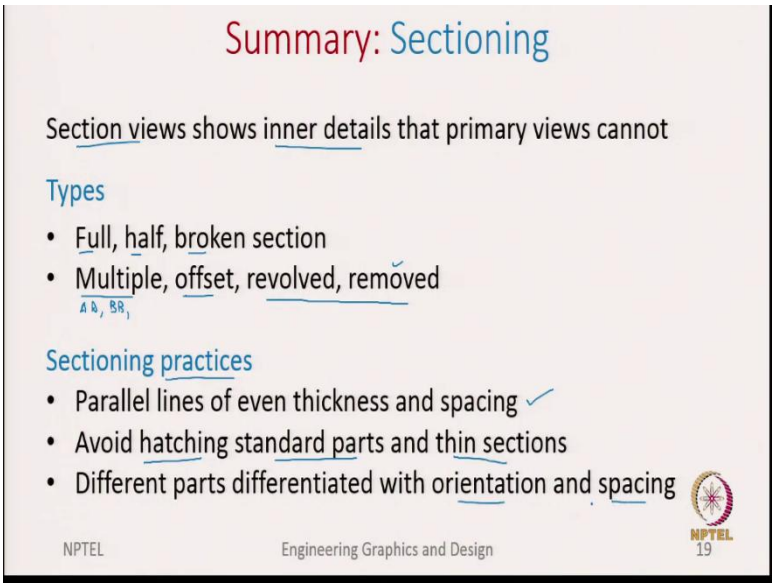

So, finally, we summarized what we have been discussing till now about this important concept of sectioning. First, we said, we use sectioning because it shows the inner details, which the primary views cannot capture. The primary views like the front side and top views cannot catch. And then, we also looked at different kinds of sectioning, saying about half section, full section, broken section where we are either showing the full section or only half of it or maybe partially at a corner of the part.

It all depends on, what kind of features you want to show during this sectioning. We also talked about multiple sections where we said, each section may needs to be designated with its own reference letters. So, like, A-A, B-B, and so on and so forth. We also discussed about this offset. Especially, we have seen that if there are more features and you want to show multiple features using a single cutting line, then you can use this offset sections.

And finally, we also discussed about the revolved and removed where we want to show the true cross section of an object. When we are looking at the true cross section of an object that is when we either can choose the revolved where we show it on the primary feature itself, the section on the primary feature itself, but if we move this section away from the primary feature, that is when we call it as the removed sections.

Finally, we also talked about the practices people follow when doing these sectioning. So, we talked about having parallel lines, which are of uniform thickness and uniformly spaced. We also discussed instances when these hatching or the section lines needs to be avoided. Even though your cutting plane is cutting through some of the objects we need to avoid showing

the hatching, especially for standard parts, shaft, bolts, rivets and thin sections like the ribs we have discussed.

And, finally we said, if you have an assembly with multiple components on the sectioning plane then how do we differentiate the different objects? By choosing a different orientation or spacing for those hatching lines? I think, with this we complete the sectioning part. You will be, this lecture will be followed by tutorials where we will show you in one example how to start by showing the primary views and then by showing the cutting lines and the viewing direction. How do we proceed and show the section views?

In the next class, we will be looking at another aspect of projections called the auxiliary views. So, let us meet again in the next lecture. Thank you.