Engineering Graphics and Design
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Week 2: Graphical Representation
Multiview Projections

Welcome back, we are on week 2 of graphical representations. In previous class we looked at projections as a means to get the engineering drawing, we looked at various kinds of projections, but today's lecture will focus more on the multi-view projections.

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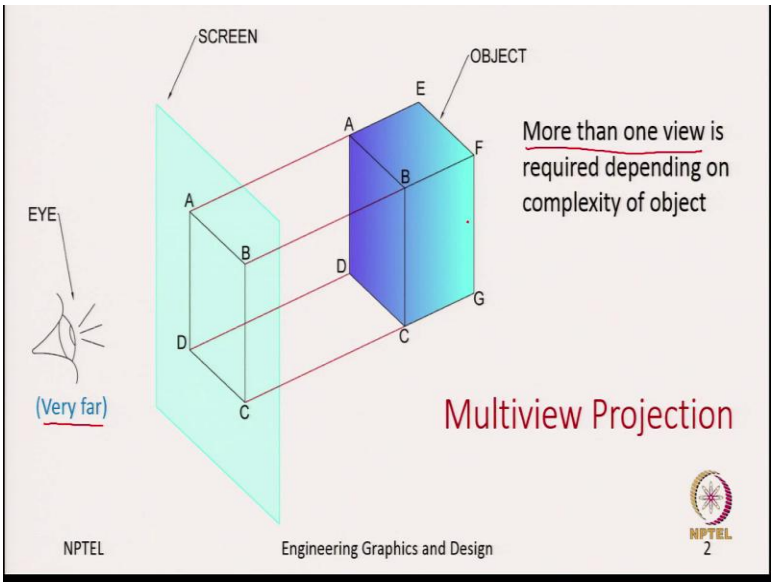

So, this is what we have seen in the previous class saying that you have three things, one the observer who is looking at the object, then second is the object, and third is the projection plane. So, for multi-view projection we said the observer is looking at far distance. So, since he is very far, therefore the projectors are all parallel.

And the other thing we looked mentioned about the multi-view projection is we said you are looking at one face of the object, straight in, so which means you are directly looking at the object. So, for example, if your object is as simple as a cube, like I am holding, what you will see in the front view if you are very far, you will only see the front face, which appears like a square.

And we also said the unique thing about the multi-view projections is, since the length here the horizontal length and the vertical length these are parallel to the projection plane, even in the projected view, this lens will remain the same. So, let us say if this block is of 50 millimetres side, then even on the projection plane what you see is a 50 by 50 square.

But an important aspect or the limitation of this multi-view projection is probably one single view is not sufficient to completely describe this object, though you are able to describe one face of it very accurately and with true lens, based on one single view for example, here you do not know what is the depth of it, so maybe the depth is just the same as the height and the width.

In that case, it becomes a cube, but let us say if it is half, it is a cuboid and that information is not available in this single view. So, in summary, what we are saying is, we need more than one view. And you may ask a question, if it is more than one, is it two, three, or even more than three? The answer is it depends on the complexity of the object.

And who decides how many views to choose? It is the person who is drawing. So, depending on the way he sees the object, you need to decide how many views you need to represent the object. And when you are choosing or making that choice of number of views, you need to keep in mind that your goal is to convey the information within which is as unambiguous as possible.

So, which means depending on the views, it should lead to only one object, it should not lead to two different possibilities of an object. And the second is, you again do not want to provide plenty of use, because then you are repeating the same information. So, if you think two views are sufficient, you should choose those two views appropriately and then convey the information.

You need not bother about showing more views, because then you are repeating the same information again and again. So, we said that depending on the complexity we have, we need multiple views, but how do we capture these views? Is there a unique way of capturing it? That is what we will understand in the next part of this lecture.

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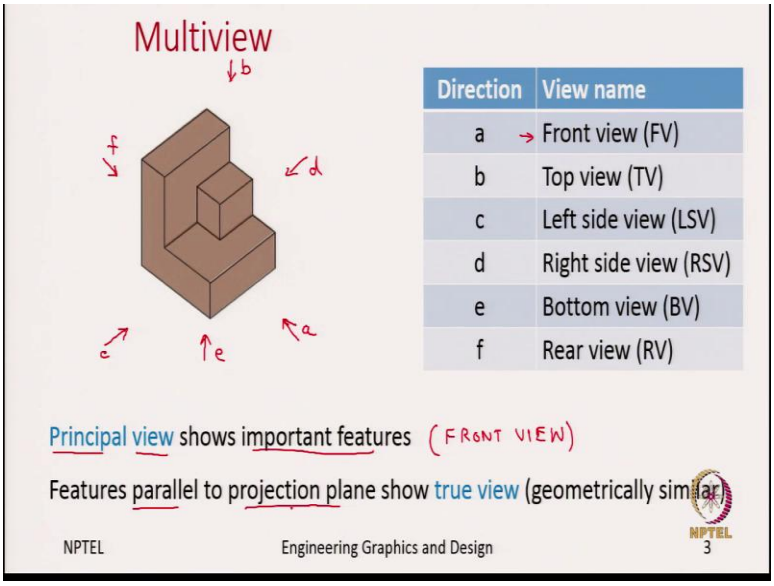

So, let us say we have an object like this, so I will draw arrows to say that this is the direction the observer is looking at this object. Let us, say I will name this direction as ‘a’, so since we are working with 3D coordinate systems, you can say there are 6 different directions or proper directions from which you can look at this object. Of course, one can say there are infinite number of directions, but let us focus on 6 common directions.

So, let us say if you are looking from the front of the object, this is the arrow and I named it ‘a’. Now, let us say the observer is looking from top, so that I will name it as ‘b’. So, notice here that here the object is fixed, what is happening is the observer is moving, initially when I depicted a, he is looking at the front face of the object and for ‘b’ he is looking from the top.

Similarly, I can have if he is looking from the left side’ c’, like if he is looking from the right-side ‘d’, if he is looking from the bottom we will name it as ‘e’ and finally, if he is looking from the back we will name it as ‘f’. The reason I am naming these is, because depending on the direction you look the view which you capture on the projection plane has a name. And then those names are here.

So, if you are looking at the front, the view you capture is called the front view. And from b where you are looking from the top, what we capture is the top view, sometimes called TV depending on where you want to use. And similarly, if you are looking from the left you have the left side view, looking from right you have the right-side view, looking from the bottom we have the bottom view and looking from the back you have the rear view.

So, these are the 6 conventional views. So, mind you here I am not showing you what is the view? So, that we will be looking in the next slide. But what I am trying to say is for the same object you can capture multiple views. So, now the question is how do we capture those views? So, that we will be discussing in the next slide, but before that, let me introduce you something called as principle view.

So, because you may be having a question in your mind, so for an object how do I define which view is front view, or how do I define which direction is the front? So, that depends on depending on the object you have, you need to find a direction which shows the maximum amount of features on the object.

For example, here one can argue that this direction a as well as e or b, all three of them show a maximum amount of features, then it depends on the person who is choosing, for example I may choose as my front view, and some other might choose something else as a front view, that might vary, but the basic principle is, you need to find a principle view which shows all the important features.

And most often this principle view is made as the front view. And I think this is what we have already mentioned saying that features that are parallel to the projection plane will show there true geometry. So, previously we have seen depending on the orientation of the object if any edge is parallel to the projection plane, especially in these orthographic projections, the same length is captured on the view. So, essentially we said there are 6 proper views and now the question is how do we capture these views.

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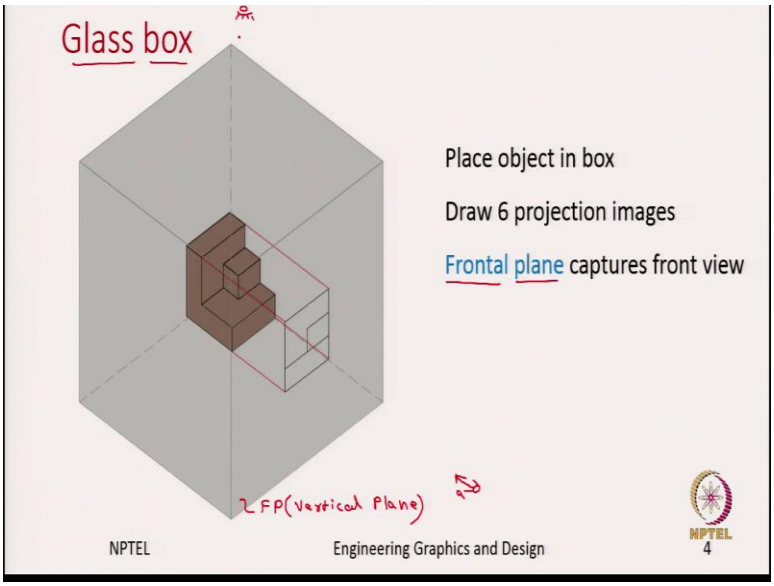

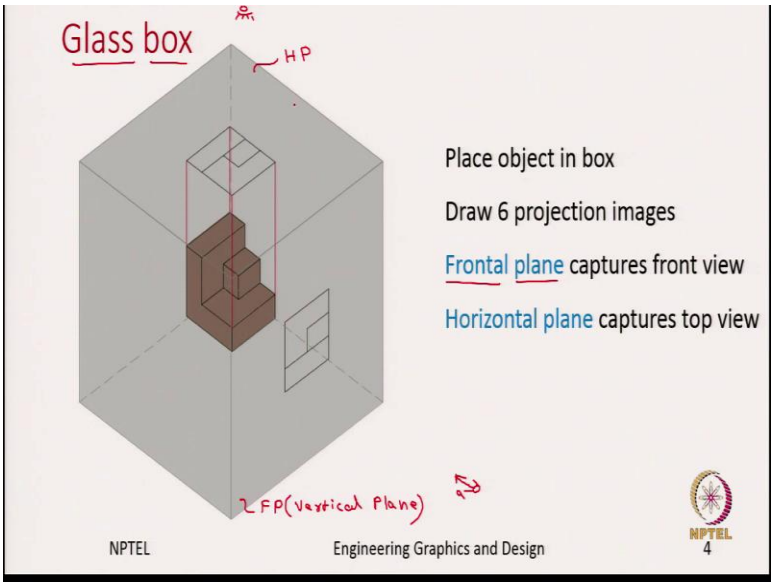

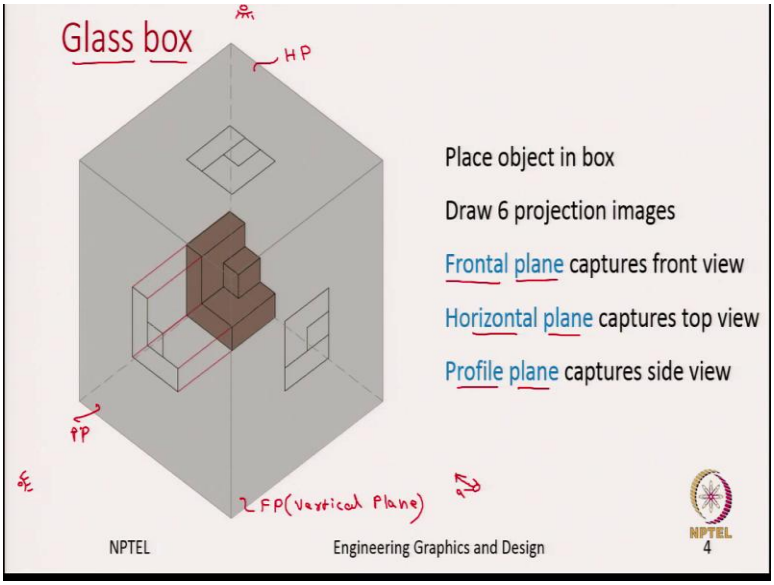

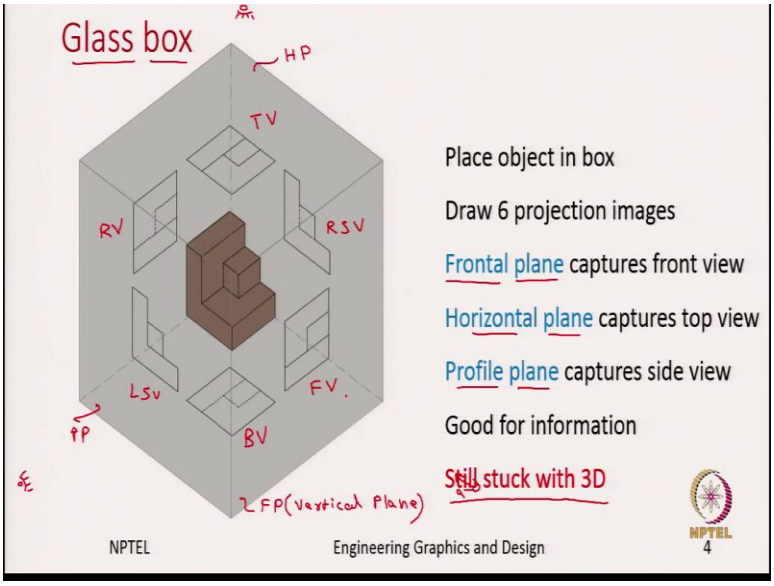

One way to capture this view is to think about something called as a glass box. So, here we say that there is a glass box, so which means all the sides are transparent and now if we have an object, we want to place this object at the middle or the centre of this glass box. So, let us place it place the object in the box.

Now, we have the glass box and the object and the object is sitting at the centre. Now, we need to draw the 6 projection images, so for that first we need to look at where the observer is looking. So, let us say for the front view we said this is direction a, so which means the observer is looking from here and then we said that the projection plane lies between the object and the observer, so in this case this is the plane.

So, these are the four projectors which are used to capture the boundary of this front view. So, here is the front view. So, let me say that this plane on which we are drawing the front view is called either the frontal plane, so this is the frontal plane let me write it as FP, F standing for frontal and P for plane, we can also call it as vertical plane, next when we want to capture the top view we said we the observer we will be looking from the top.

So, which means the observer is looking somewhere here from here. So, first we will draw the projector lines and then draw the complete view. So, where did we place this top view, we are placed it on the what is called as horizontal plane or in short HP. So, horizontal plane captures the top view. Similarly, to capture the left side view we first draw these projectors the eye is somewhere here, since we are saying we are capturing the left side view we the observer goes to the left of the object and looks towards the object.

And these are projected on this plane which we call it as profile plane. So, the profile plane captures the side view. So, in short we will call this plane is PP profile plane. So, we are done with three important views which are the front view, top view and the side view. Similarly, you can do for the rest of the views which are the right-side view, bottom view and rear view.

So, let me write down on this picture itself what are the front view, so this we call it as the front view, top view, left side view, right side view, bottom view and the rear view. So, using this box, what we are able to show is we are able to capture the 6 different views. So, good, we have solved this problem, but we are still stuck with 3D, which means though all these views are 2D now we have 6 views which are in the 3D space.

But at the end of the day, when I want to do an engineering drawing, I need to draw it on a sheet of paper, which means all the 6 views should sit on a paper. Now, the question is, how do I bring all these 6 views and put it on one sheet of paper? The solution is to open the box, think of a pizza box. So, you have the object in middle, so the pizza and then once you open the box, all of them fall in the same plane.

Similarly, we will do the same, but when we do this operation, we should keep this in mind that the front view is the primary view, so which means we will not disturb the front view the front view will remain wherever it is, all other remaining 5 views there will unfold and be parallel with this front. So, let us see how it happens.

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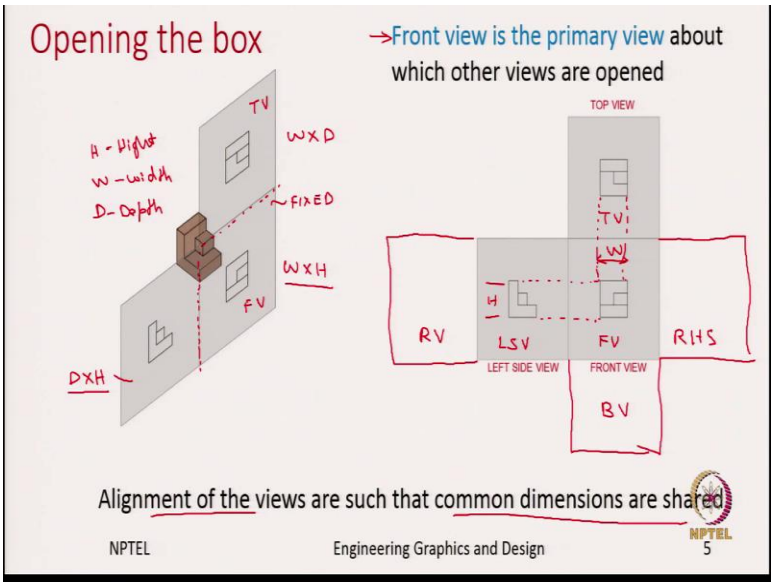

So, again we have this box and in that box we have this object, so we have captured the front view and after that we have capturing the top view. Now, comes the question, how do we unfold the box? So, the question here is we said that the front view is primary and we are not moving it, so which means the front view is fixed.

Now, that top view what we have captured this needs to be open, how do we open it we open it? We open it on the about the edge which matches with the frontal plane and the top plane, so about this edge I will rotate it. So, if you look we are gradually opening this top view. So, since we captured this top view on the horizontal plane, we are rotating that plane, so that finally it is in line with the front view.

So, let us do the same thing with the side view. So, here is your profile plane on which you can capture the side view, so we have captured the side. Now, again we need to rotate this side view such that it is in plane with the front view, how do we rotate? We again choose the edge which is common with the front view.

So, that edge is this line and if I rotate this profile plane about this line, this is how it opens gradually. So, what we are able to do is both the top view and the side view, we have opened them such that they are in line with the front view. Now, all of them are in a plane and this is how it looks like when I depicted on a piece of paper.

So, where you have the front view, top view and left side view. So, I have only showed you the 3 views, but there are 3 more views. So, you can continue the same procedure to open up and show other views also. So, for example, the right-side view will be to the right of front view, so let us say this is the right-side view.

And the bottom view will be below the front view and the last one is the rear view. So, rear view, you can either place it to the left of the left side view or to the right of the right side view, but we normally place it next to the left side view. So, let me show it here, rear view, this is how we open the box such that now what we happen, what we can see is all the views are in a single plane.

So, if you have noticed, we said that the alignment of views is such that common dimensions are shared, so now let us focus on the front view and top view, which dimension do they share? So, for example, this object has height H, W for width, and D for depth. So, the front view what will it capture? It will capture the width and height.

And similarly, the top view will capture width and depth. And the side view will capture the depth and height. So, now let us focus on front and the top view, what is common between them? Both of them captured the width. And you look at the placement of the front view and the top view. So, for example if I extend these lines, they are all aligned.

Similarly, if we now pick the front view and the left side view, what is common between them? So, the front view we said is width and height and side view we said is depth and height, so which one is common? The height is common. So, if you extend these lines, so as we know this is the height of the object and these lines are perfectly aligned between the left side view and the right-side view.

So, this helps, so for example, when you are working with complex objects, maybe you first draw a front view and once you draw the front view, you have some information before you start with the left side view, because for example here you already know the height of the object, so that information you can use from the front view. Similarly, when you are drawing the top view you can use the information of the width that helps you in developing these views gradually.

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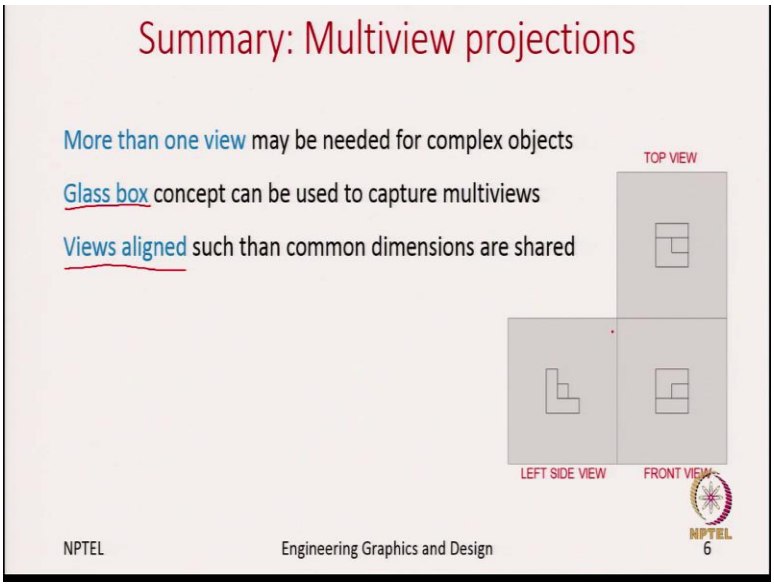

So, let us look in summary what we studied in this lecture, what we said is for multi-view projections, first they capture the true length if the edges are parallel to the projection planes. But we said that maybe one view is not sufficient to completely describe the object, you may need more than a view more than one view. And then we said, let us say okay we will pick these 6 standard views which are in line with the 3D coordinate systems.

So, one way to capture that is to use this concept of glass box, where you place the object in this glass box and then capture all the 6 views. And finally, we said once we capture these views, these are 6 views in still lying in the 3D space, we want to bring them all to a single 2D space, for that we have opened the box such that all the views are on the single sheet.

And finally, we noticed this opening is not random, we open it in such a way that the views are aligned and the common dimensions are shared. So, we in the previous slide we already showed that left side view and the front view shared the height and the front view and the top view shared the width of the object. With this we will end this lecture, we will meet again in next lecture. Thank you.