Textured Yarn Technology
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Lecture - 18
Draw Texturing: Positorque System

So, we are continuing with the friction texturing. Some development took place which became quite an important development in this which is called the Positorque System. So, will take some time to just learn about this.

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So, just before what we have seen is the effect of process parameters and their effect on crimp characteristics and the quality characteristics. So, crimp characteristics we talking about the crimp rigidity quality, broken filaments and tight spots etcetera and we learnt that the way the things are friction is going to be the way you going to be texturing, but slip is going to be inherent in this whole process and therefore, tight spots, broken filaments, surging is we will keep on expecting. But, as I told you before also lot of coordination and research is happened between machinery manufacturers the research institutes, along this area and the texturing to understand as to what we can do so you understand and recognize that there is a problem and then you see if you can something can be done. So, today you will just look at the concept what people did later.

So, this is something like called concept of zero slip. Now, zero must be taken as a misnomer, we may never get a situation where slip is zero whether we are going towards zero, that is what basically is the concept and once we look at it, it looks some kind of a interesting thought process, till the time you had not done it you all had more problems. So, once you did it appeared oh my god it is so easy right, but that is how it is?

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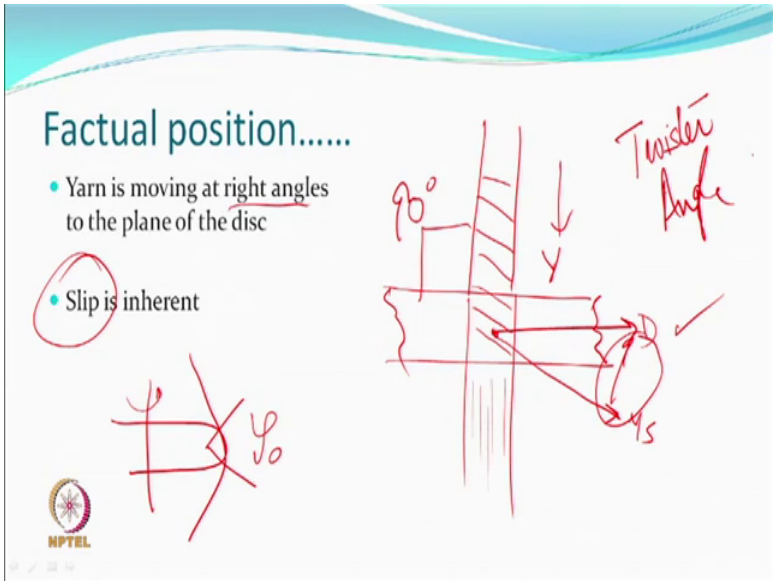

So, current factual position is that you have a disc which is rotating in a plane all right; disc is rotating in a plane. The yarn let us say is coming from vertically from top to bottom let us say. So, this is the disc and this is the disc surface, your yarn is coming vertically but, maybe it is making a wrap angle right so there is a wrap angle.

So, otherwise the plane of the yarn and the plane of the disc is at right angles. Let me repeat again, the disc is moving like this and the yarn is coming vertically like this, instead of coming like this, because, we said then that would mean zero wrap angle which; obviously, is not going to give you any twisting.

So, instead of doing zero wrap angle what you are doing is trapping it, but if you look at the plane of the motion of the yarn and the plane of the motion of the disc, they are at right angles right that is what it is?

So, we show it also like this. So, you do have a wrap angle let us say some psi naught and you are rotating. The disc is rotating in one plane, the yarn is coming in the other

plane and this is what we notice last time the direction of motion of the disc surface, which is let us say this and the direction of motion of the yarn, which is here they are obviously, not in the same direction and so at any given point where there is let us say point contact, the actual surface of the yarn which is being twisted is moving in a direction, where the directional frictional force may be there.

So, when the force is being applied a resultant force is being applied at an angle, which is resultant of the vector, direction, velocity, of the discs surface versus the yarn surface yarn actual, but the yarn is not just passing over it is rotating also; that means, it is getting twisted. When it gets twisted, what will be the angle at which the outer filaments are going to be there, that will be probably governed by the speed of the two all right; ratio relative speed?

But, what it means is that this yarn is not being wrapped around itself at right angle, it is being wrapped at the helix angle. So, there is a helix angle right. And therefore, the surface of the yarn which is being moved and that helix has been created, because the surface is being forced to move in a direction, which is different than the direction of the disc and the direction of the yarn movement.

So, let us say this is the way the twist were being inserted all right. So, the actual motion of the surface at that point as per the yarn surface is concerned this. This is definitely different than this and so there is slip right; the slip is because the difference is there and when will that can change it can only change at least in this respect, when the motion of the surface of the yarn in the same direction as the motion of the disc surface. If, that happens then you can expect a change to take place that this difference in the vector you want to make it 0 in that case what will happen is, the yarn is also surface rotating about disc is rotating in the same direction, yarn is also the direction is same maybe rotating in the other way. But, this condition where the two vectors are actually pointing a different directions, definitely leads to slip. So, this is the problem that they wanted to address, you what can we do. This angle is 90 degrees and this angle was called also a twister angle, like on the twister the yarn is being presented at this angle. So, wrap angle is different twister angle.

So, as long as the twister angle is 90 degrees, you can never expect theoretically that there will be no slip, if the theory says there will be slip, so practice all will say the slip. We say, what do we do?

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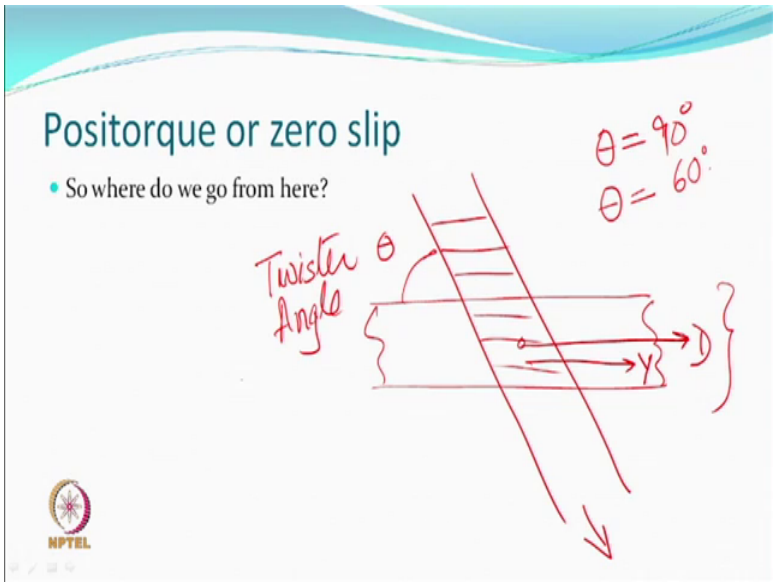

So, this is what is people did after a bit of thought and the exercise. Why should the twister angle be 90 degrees? What is the twister angle we said 90 degrees, the plane of the disc is let us say horizontal and the plane of the yarn motion was vertical, this was 90 degrees. Now, what is says is can we do something that this plane remains the same which cannot change, instead the yarn moving like this, why can not the yarn move like this, you understand what I am saying, why should the yarn only move like this vertically, why can not the plane of the yarn be at some angle.

It enters like this wraps and then goes there right, enters like this wraps and goes there; that means, you are saying the plane of the motion of the yarn is not at right angles, but at a different angle. So, originally we will thought what I talking about, but what it does is this if you appropriately put it, this is now the twister angle, which is not 90, but some angle let us say some theta. So, twister angle instead of being 90 degrees this is at some angle, let us say somewhere around 60 degrees or around. So, you can appreciate is a different than the wrap angle, consequently wrap angle actual value of a wrap angle as seen from one side would be different than you know what you see as a profile an angle,

and what actually is the angle maybe different, because, now this is wrapping at an angle at a different plane.

Now, what it says is it is going to be twisted, but because of this angle the surface of the yarn which is being twisted at whatever helix angle that it has is if it is in the same direction as the motion of the disc, then the difference will be only how fast one is moving, how fast the other is moving. So, that is the yarn speed may not be equal to D, because when you start the machine it was 0, then it will keeps on picking up, but what you have done is we have taken care of this part.

So, this was called the zero slip concept and the commercial systems which is brought into the twisting system and texturing friction texturing were called the positorque systems. So, it is it was not called a positive twist, we still have no control on a positive twist, but we say we are manipulating and so it was positorque system. This was a kind of a revolution although the concept is simple.

So, if theoretically if you can definitely say that my direction of yarn surface movement and the disc surface movement is the same, then you do away with this , but of course, if there is a difference between the two values magnitude, that difference will still exist and so there may be slip you get the point.

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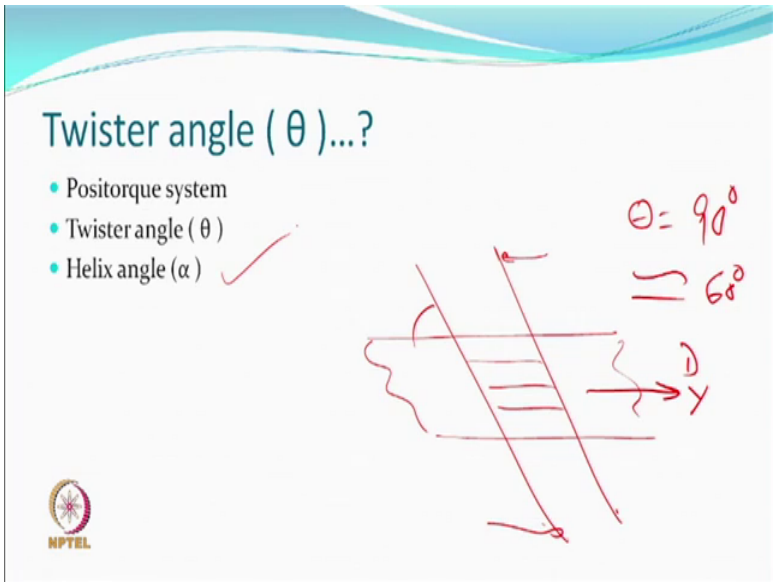

So, what it says, so you have a positorque system, say have a twister angle this a defined as theta and we know from our previous discussions and otherwise, there is the helix angle also. So, in some sense what they are trying to say is, if the helix angle is equal to twister angle; twister angle is on the machine, helix angle is the result of twisting ok. Helix angle is the defined on the yarn, the twister angle is of the machine. If, the twister angle is equal to helix angle, then you can expect zero slip or a positorque condition right.

So, say we have solve the problem, now we have solve the problem. So, only thing is just like there is a lag, there may be a lag disc is moving faster than this yarn because of the thing, but if contacts are nice, tension is good, wrap angle is appropriate, then you may say well it may not even lag, it may just reach up to the same limit and if there is no slip; that means, you can actually think of broken filaments can be reduced, tight spots can be reduced and even surging amplitude frequency could also be therefore controlled.

So, we seem to have solve the problem, but what still remains is whenever you are trying to optimize d by y, draw ratio everything changes, the twist will change, but the twister angle cannot change because, twister angle is a machine parameter, which has been fixed already, you can choose one disc versus the other discs, versus the other disc, but once you are chosen then you are doing any optimization, then the helix angle can change and therefore, you may not be exactly in the same direction but you would have solved the problem quite a lot much more the problem was when the angle twister angle is 90 degrees. So, this is what we are looking at a positive system.

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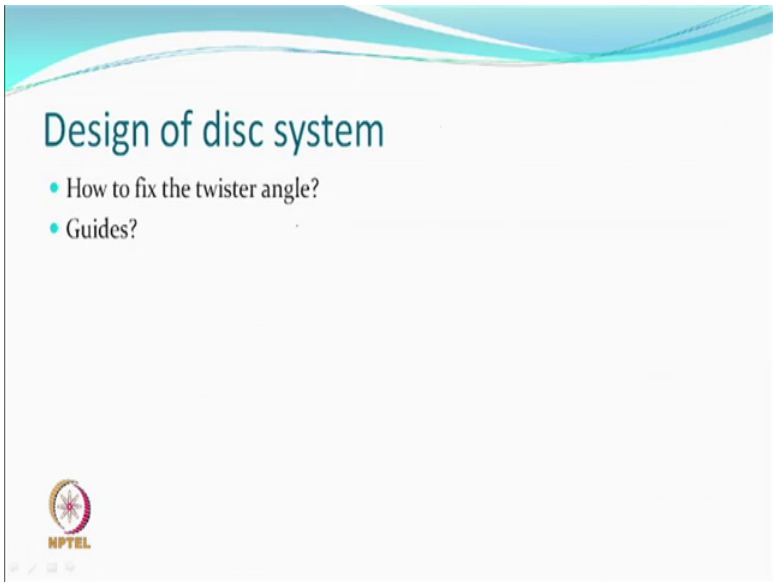

So, how do we design a disc to fix this twister angle? Well one could be why do we have to have the guides in the vertical plane; the guides could be at a different plane. So obviously, yarn has to follow right. So, one can always designs things so that you can fix a twister angle there is no doubt that if you change the twister angle it becomes another parameter right. So, you had angle of wrap as a parameter and now twister angle also is a parameter, if you change this something will change.

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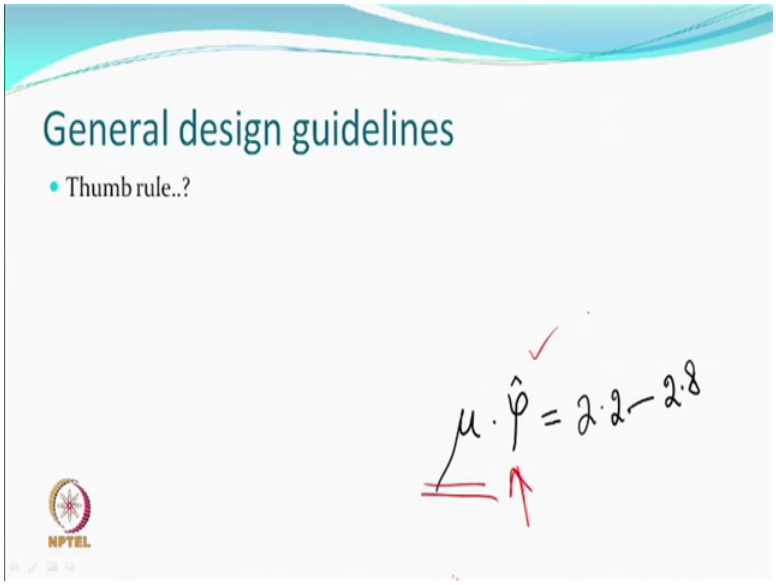

So, let us see what we can do? There is a how do we decide as to what will the wrap angle? Twister angle you got some guideline look if helix angle is equal to twister angle, twister angle could be equal to helix angle, because you know the denier of the yarn and that of you know what twist approximately there. So, that you have some idea and you can say well this is it, but what it means is every machine is going to be having one twister, for one type of a yarn, which will be difficult you will have a range. So, there is going to be a possibility that you may not have achieved 0 value, but you would have come very near to 0. So, what should be wrap angle?

So, this is a thumb rule, which people use to decide as to what kind of a material and what kind of wrap angle could be interesting? So, mu is the coefficient of friction or whichever material you have polyurethane disc, you have aluminum disc, you have a ceramic disc so, material you change, the mu will change. And then this is the wrap angle, but not in degrees, but in radians.

So, if you have this wrap angle in radians and the product of coefficient of friction and wrap angle in radian should be in this range of 2.2 to 2.8, then you say we are approximately going to cover the thing.

The twister angle should be based on the denier range so, because that will change the helix angle. So, well between this to this helix angle, that mean this type of a denier, this range of denier should be persisted, if you have different range of denier, then you use this etcetera, but the wrap angle how do we decide where do we put the guide for that matter right. So, that will be based on again the range of helix angles.

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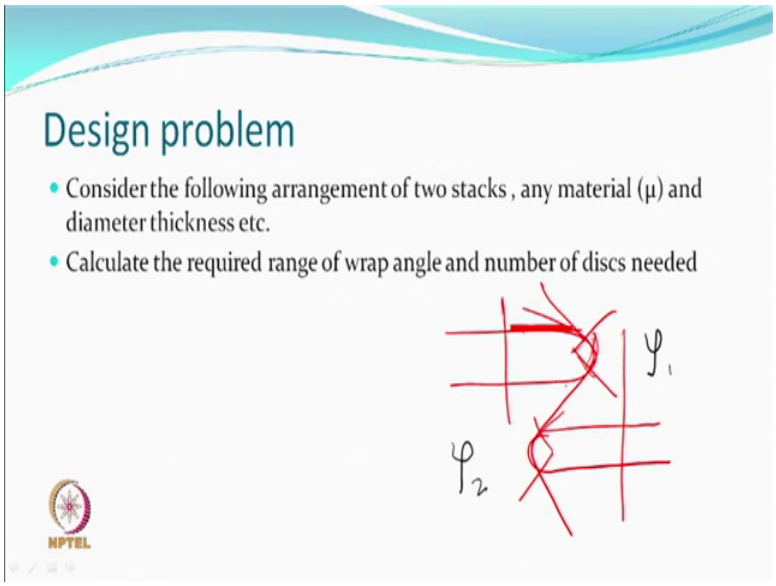

So, you can look at this design problem, you will solve this design problem ok. I am giving going to give you put it on that thing as a bonus assignment, you know what is a bonus assignment, which you may not have done very well in the minor ok.

So, we can add the bonus marks right. So, what is the problem? The problem is that guide of course, may be there at the end, but there is there are parallel discs mounted on some axes, let us say one disc is in the top, which is rotating at the bottom there is another disc, rotating in a manner then there is no contradiction right.

So, the yarn is going to rotate in the same direction all right. Why more than one disc, because this thumb rule may give you some angle and if you take only one disc you may not be able to achieve the angle that, let us say this particular thumb rule says. You cannot make the yarn move parallel to this, it will still be moving like this. So, there will be a range, which will be one angle. If, suppose you need more than this angle, then what you do? One thing you can do is change the curvature, make the thickness more, rotation of course can change because of the diameter, distance between the 2 discs can be changed. If, you change the distance between the two then the angle wrap angle can change.

So, what I am saying is you can take this, but I will put it on the module also, that there are two stacks of discs, which may be in one along one axis, there may be one or more, in the second axis also there will be one or more depending upon what material have you

chosen. So, you are free to choose a material, which will have a different view, you are free to choose a diameter, you are free to choose the thickness of the disc, you are free to choose the distance between the disc and, geometrically try to tell us, what should be the wrap angle based on the thumb rule range of angle because when if a range there so, there will be range there and how many disc would you need to achieve your goal. So, geometrically you can solve this problem.

So, people have gone from the design point of view beyond this, this is a simple problem you can make it more complex.

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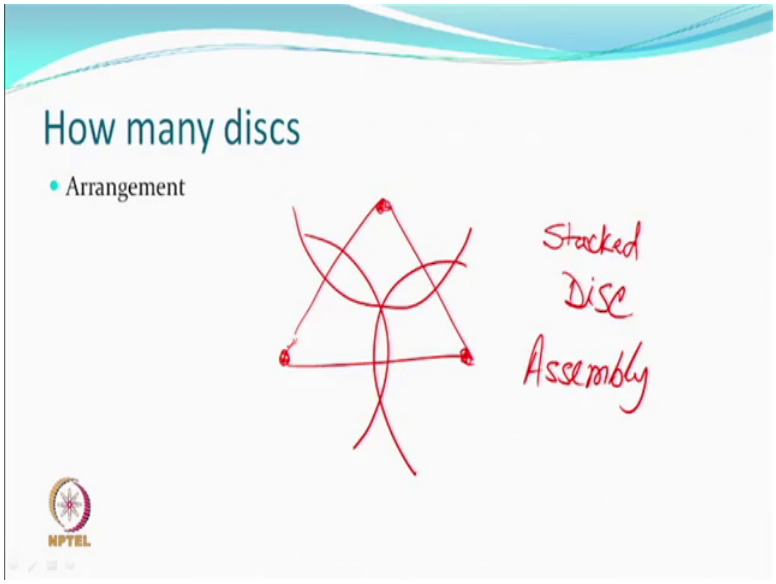

So, what you people do these days is that instead of having 2 axes for the stacks, there are 3 axes for the stack on a equilateral triangle. So, you have one axis for which there will be discs, another axis there will be discs, another axis there will be discs. So, you have one disc, the other disc, the other disc and that disc, you can make any number of discs right n number of discs. So, there will be overlapping discs. So, the discs are overlapping. So, yarn cannot just pass through without touching any one of them.

They have to yarn has to touch and one disc is here the other is here. So, it goes from one to this, from here it can go to there and then go here, then go there and come down. So, yarn is not going move straight is going to move over the discs surfaces, as it moves from one end to the other end of the stack all right. So, equilateral triangle; obviously,

diameters of all of them is the same, material will be same, number of disc would be; obviously, 3 or more.

So, it is a interesting proposition in which case what happens, when you start the machine taking the yarn through the all the discs is not a thing once you just put it the yarn automatically goes wherever it has to go, they touch it will be in the centre where it supposed to be it just go then. So, threading is not a problem the move start the machine start threading put the yarn will go inside, but they are overlapping discs all right, something like this.

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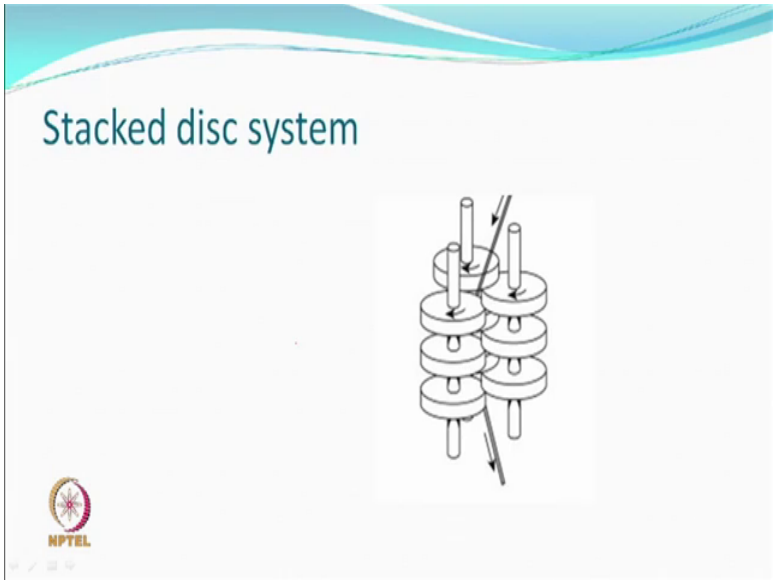

So, 3 axes, 3 shafts or valves and the yarn moves from one side goes on the other is then handle by the second, then the third, then the fourth, then the fifth, then the sixth and seventh whatever. So, this is the problem that I have given you involves only 2 axes system, not 3 axes system and only we are looking at; we are looking at wrap angle.

This arrangement will have to address the wrap angle as well as the twister angle, because the axes are now in different planes, it will be shifting. The yarn actually will be going like this and like that, if you try to trace the path of the yarn over these disc will be interesting path, trace it, you do it yourself, disc assembly.

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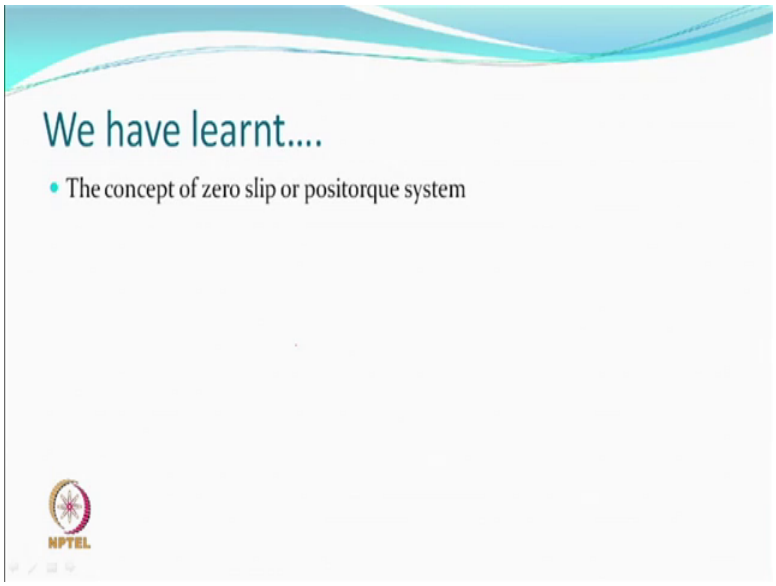

So, there we will stop today just the concept from now onwards we will take another aspect which will be different than this. So, do not mix it up.

Thank you.