Textured Yarn Technology
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Lecture – 19
Friction draw texturing

So we are continuing with the draw texturing in fact, friction draw texturing, because we looking at the device which can do the twisting at a faster phase, but using friction and we try to understand the concept, where it should be possible to reduce the slip in the friction texturing system, during twisting, that was called the concept of positorque system and what we introduced was a twister angle and we realize that the twister angle should not be equal to 90 degrees. If, it is close to helix angle, then the slip can be reduced.

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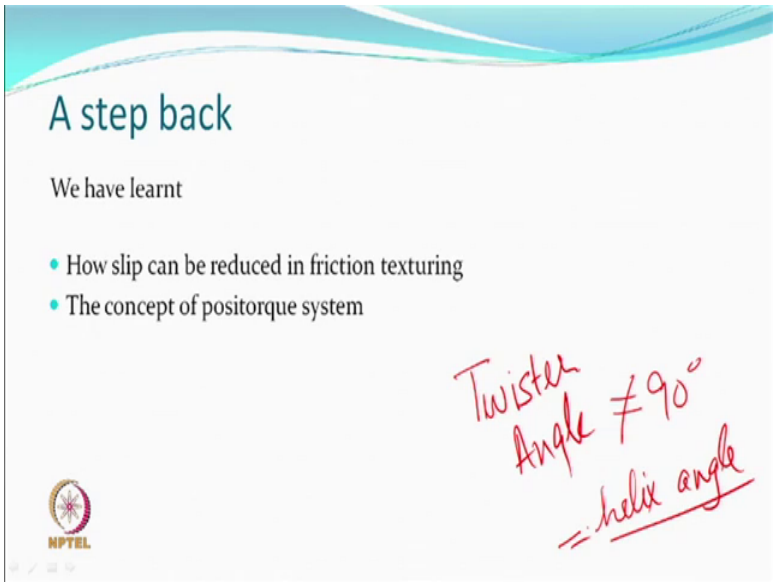

So, but we cannot really guarantee that the twister angle would be equal to helix angle. If, it is not equal to helix angle then, there is going to be some difference in the vector force vector and so this surface movement of the disc direction and the direction of the surface movement of yarn will not be the same, if they not same that much you can expect slip.

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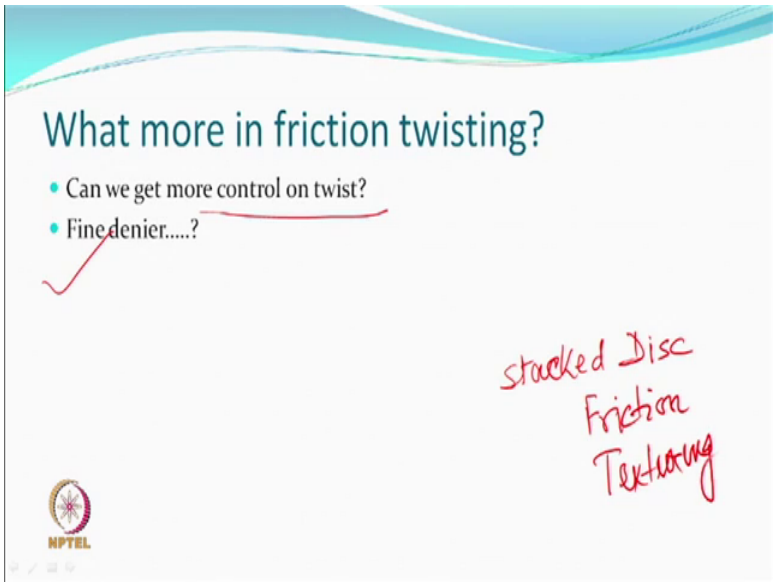

So, particularly people were quite interested in handling of fine denier material, because when you have micro denier, which means this individual filament denier are less than 1, that means, that there is going to be more broken filaments chances of more broken filaments are going to be there and so you were looking at something, which could have probably more control on the twist than what we have. What we have is a control based on the tension and the angle of rap. Beyond that, we do not have a positive control in what we called as the stack disc friction texturing. So, that is the question.

So, then this new newer concept came as a nip controlled vector drives, that is you are passing the yarn through a nip and that becomes an issue that how do we control the nip or how do we produce a nip in a friction texturing system.

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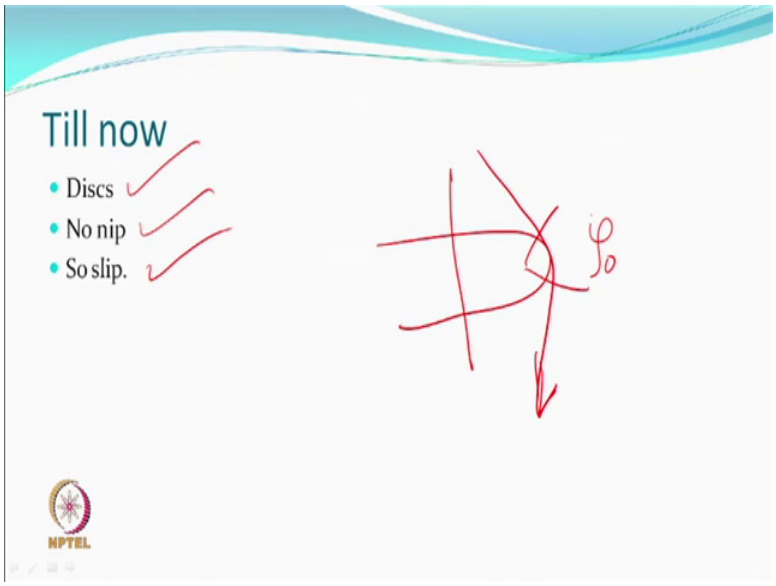

So, our discs at the movement which we were dealing they have no nip and there is slip, what you have is something like this and the angle of rap. So, no nip, so slip and that is what we have. So, what can we do?

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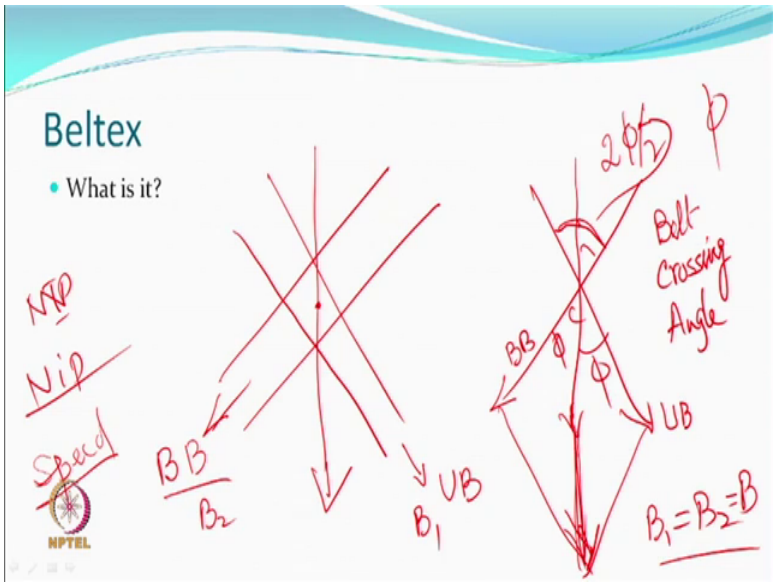

A system was proposed called the Beltex. The beltex obviously, it appears that there are belts. Have you seen in anywhere people in villages or otherwise twisting beyond with hands right. So, this hand if the yarn is somewhere here and you are twisting like this, so

you are actually providing a nip. There are two sides and in between two surfaces and in between there is some yarn.

So, this beltex system wanted to utilize that concept, that you actually provide a nip where for example, two surfaces are moving and the third surface also so there are three surfaces now we were looking at.

So, this is the belt let us say this is the yarn and so what we have there is a let us say a belt, which can be let us say upper belt, which is moving on top of the yarn, and there is a bottom belt, which is moving below the yarn and the yarn is let us say moving in this direction.

So, this is almost creating this type of a environment and what is this? Let us say at this point if somebody wants to understand what is happening to the yarn. So, what you have is a force diagram of some kind of this. So, you have let us say bottom belt and upper belt, speeds or velocities if that is controlled, then you have the resultant force acting on the yarn, which is going to take it forward all right. So, now, you have; that means, if you have two surfaces moving like this. So, there is a chance that you have a force which is acting in the direction of the diagonal of this parallelogram and so we have a condition where there is nip. So and how is this all being decided? This is being decided by this angle it is the belt crossing angle. Let us say this belt crossing angle is 2 phi. So, what can we do? We can change the speed of the belt, speed of the belt can be changed, let us say the speed was B 1 and the speed is B 2 in a generalized system.

So, these speeds can be change maybe you would like to skip B 1 is equal to B 2, otherwise what will happen? The direction of the frictional force will be different than the direction of the yarn and therefore, the other thing also which is there is, that the yarn is actually moving in the centre of these belt crossing; crossing belts. So, that this is half of 2 phi; that means, actually this is phi 2 phi by 2 and that is phi. So, you have half belt crossing angle a phi; that means, other half is also phi so both half phi and therefore, the yarn is moving in the centre and if B 1, B 2 are same then obviously, the direction of the force that is going to be exerted on the yarn also will be along the direction of the yarn movement.

So, what do we notice here? That you have two parameters; one is the speed the belt let us say it is B and you have another parameter, which is the belt crossing angle half of the

belt that also can be change. So, if you change the belt crossing angle, your component of the frictional force magnitude will also change and of course, you change the B this magnitude will also change. So, these are two parameters now you have.

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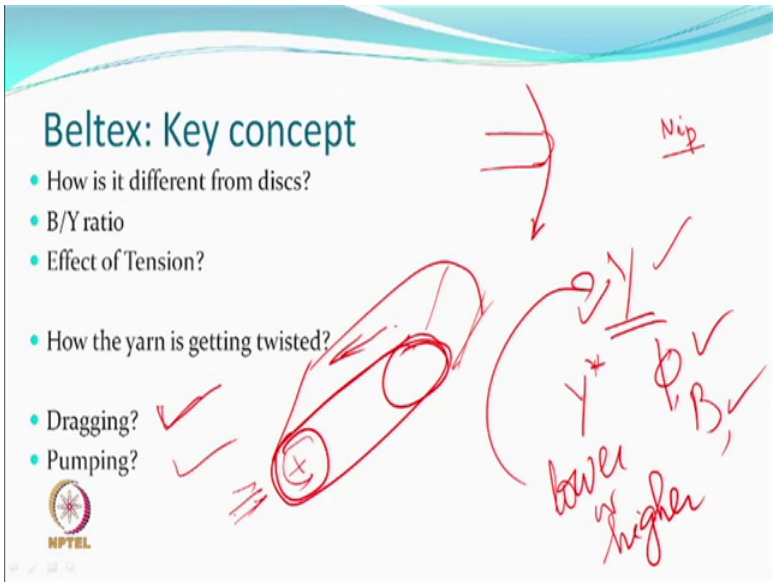

So, how is it different from the disc? Yes, we have a nip that is one difference, but the other difference is the yarn in this case was moving after wrapping over the disc surface and which was considered essential otherwise, we may not get any frictional force and the torque as we was considered necessary. And what is happening here? The yarn is passing vertically, the plane of the belt is another plane, plane of the other belt is another plane so you have 3 plane surfaces; one is the bottom belt plane surface, other the surface of the inner surface of the top belt and the plane of the thing, all of them are parallel in this situation all of them are parallel.

In this case, the surfaces surface of the disc let us say at any point. The plane at there is a motion versus this were actually at some angle all right, if it was no twister angle they were 90 degrees, if there is a twister angle there are different so, there are different planes and in top of on top of that you had, what we call as rap angle and we understood that the tension and the rap angle together will play some role in deciding what will be the normal force and therefore, what will be frictional force.

In this case, what will be the effect of increasing tension, let us say on torque, what should be if we increase the tension. So, we have a some control so what will be the effect of that on the twist.

So, remember so we have belt moving in the same plane, parallel plane not same plane. Motion of the belt surface motion is parallel say to the plane in which the yarn is moving versus the other surface they are all parallel; you are increasing tension what will happen? The tension in the yarn will increase, but on the torque; will the torque increase; the torque increase? Yes, why will the torque increase yeah?

Student: Reaction force increases normal reaction force increases.

So, where is a normal? Where is the component?

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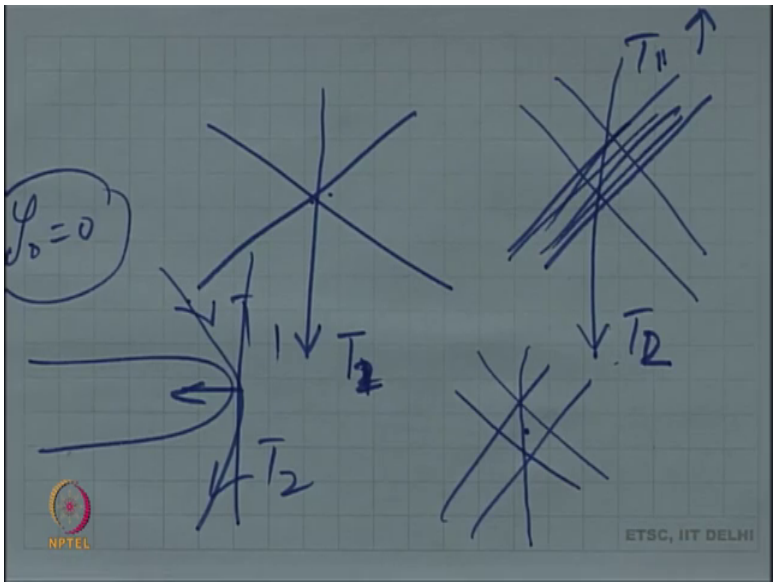

So, we have a situation like this, yarn is moving or let us say this was one of the belts the yarn is moving like this and you want to increase tension in this, tension in this, let us say it is T 2 of course, and this is T 1 on this side because this moving. So, you want to increase T 1, whatever effect have has happened will happen whatever, they are in the parallel. How will you get the normal force?

If this was simple not simple, but anyway it was simple sense that when you increase the tension, then the normal force would be generated and there also be said, if you actually move it parallel and the angle of rap is 0, if psi naught is 0 and you increase the tension,

what will happen to the twist no twist. So, here again you have a parallel surface, which is one surface which is in the same plane and in the next plane parallely something is moving and you increase tension in this. So, how will the twist come? So, you will not get twist. If, this remains the situation that three things are moving in parallel planes, you will not get the twist, but in this hand spinning system you still had twist, what is the catch? So the catch is you are actually poring pressure, independent of tension.

So, you are providing, you should be providing a normal force, which would be acting let us say from if these are the belts. So, something on the top, which is perpendicular to the plains of all the 3, at the nip point some pressure must be put. How do we put the pressure is the different story, but you must put the pressure. If, you do not put the pressure then, there is no twist, because tension cannot provide normal force, that is one difference that you have between the nip, type of a material which is called the belt, belt pair of belts, versus the disc.

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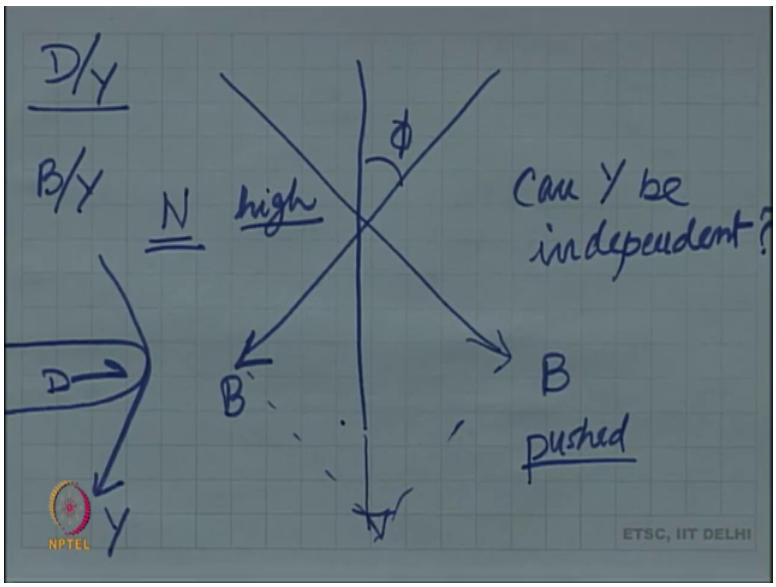

Then also we said that we have speed B with which one belt is moving, another belt also is moving with the speed B and then you also have angle of cross crossing angle and so, based on this you have the direction in which the yarn will be pushed, yarn cannot remain stationary. So, the result of this is if both the things move continuously, both the things move continuously, then something will move also because of this reason. So, if

somebody says, that in the other case we had D by Y ratio. In this case we can say B by Y ratio, but important thing is Y can the Y which is the speed of the yarn be independent.

In the earlier case of the disc without any doubt, the yarn could be moved at the speed of your desire because, there was no nip, so you could independently vary the speed of the yarn and the speed of the disc and then calculate whatever you could calculate or interpret the twist which is being inserted, but in this case this speed will be decided by this or this. So, once you are fixed the belt speed and you have also fix the belt crossing angle, which is the adjustment on the machine and then the speed after, that will be very difficult for you to change the speed of the yarn.

Particularly, if the normal force is also reasonable, the force has to be high enough to ensure no slip, after you are coming here for no slip we can automatically understand if, there is no slip some of the problem that we were worried about all the time can be handled. Now, this becomes an interesting thing and therefore, somebody also made some statement that, quality of the textured yarn produced by a beltex system does not depend on B by Y, you say should depend on B by Y, because there is something called a B something called a Y, but yes you can say, but the Y is being controlled. So, you have a control good control, but this of course, is the situation. So, you have a B by Y ratio, effect of tension we have understood and you also tried to give indication as to how the yarn is getting twisted, it is because of the normal force that is being provided externally right. So, you can always adjust the planes coming close without hitting, the belts are flexible and so you can do this like your hand is flexible, but one thing which can always happen, that although the yarn speed has been decided by phi and B in an ideal situation, when these two have been fixed it should move yarn should move at this speed only. If it does not because you can always do whatever you want to do and sometimes it can also happen that, you say draw a texturing machine you have to put some tension for drawing and when you are trying to do adjust with the yarn, diameter, linear and so on so forth changing. You may have a situation where yarn is moving at a speed which is not Y, but let us say some other speed, which may be lower or higher than this, in such situation, if you are moving at a higher speed you are going to be dragging the yarn through the nip.

So, yarn pushing is less and you are withdrawing more. Of course, in nip and still belt in a soft material you may be able to pull, but then what you do damage because still the

belt is going to be stronger than the yarn and so there can be quality issues because you are dragging.

If you are moving slowly, that we called pumping in, that your pumping more yarn than you are taking up so tensions there will be reducing and it may not harm the yarn, but that is one interesting part that we have. So, how do we control all this we say well we have, control on the B hopefully they are synchronized both the belts so that their speeds are same. The direction also is maintained once, then you start the machine and then you can run.

So, what here we understood is that, there is a possibility of getting a positive control on twist or more control on twist despite dragging and pumping, we can still say that there is a much control and it is still friction texturing and because of the friction texturing therefore, the speed of the twisting is still no limit, you can twist as much as you want. So, you are in the same zone, but you are now controlling better.

So, what is important is that, you see the development of a small thing called a twisting. So, people went on from normal pin twisting to friction, then to positorque and then still not satisfied thinking about a nip controlled twisting system.

Of course, machines have to be adjusted the positions have to be done, how long is the belt going to be there obviously, the belt is an endless belt right. So, this is an endless belt; endless belt moving in some, if this is the kind of one of the profile if you see there will be two rollers and the belt is moving, one of the belt may moving like this right. So, this belt is moving, endless belt is moving and it is moving and it is endless therefore, it must be flexible.

So, there the material is such that it can bend and again recover and depending upon at what speed are you going to be running, this material will be tortured also. So, you cannot keep one is just running around and then your like no you bend, open, bend, open, bend, open in a cyclic manner. So obviously, material property that could be tested fortunately textiles are good materials belts are made with a reinforce textile systems, you can still make them.

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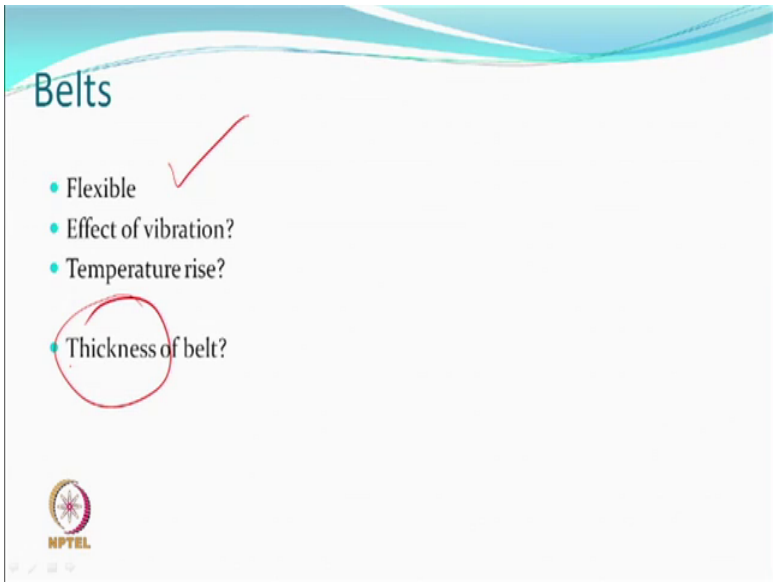

So, these belts are flexible, but when you move the machine in a fastest speed, now looking at if everything is in your control say may be running at 1000 1000 plus meters per minute. So, there will be vibrations. The disk was a rigid body; there also you felt that there can be vibrations and because of vibration contexts can be lost. Although this is nip, but there is vibrations, if there are vibration anything can happen, the what if the belt can move on one direction, the other may move the other direction and so you can have some gap at some stage much less, but you cannot say no that is one other is the temperature can rise.

So, after you are still dependent on the surface of the frictional surface of the belt or the or between the belt of the yarn that you have coefficient of friction will that change with temperatures. So that means, if you are going to be having a situation when temperature will keep on rising, because the machines are supposed to run 24 7. Then, you have to have some way to ensure that the temperature does not rise too much. So, one of course, is because there is going to be this kind of a roller, which may be conducting enough thermally, it can take away or in addition you may deploy, in case you find that the temperature rises quite large.

Maybe can deploy some air jet just to cool them. This rise of temperature can depend on this if the belt is thicker and less thick both of them, when they bend and open, the total deformation from one side to the other is going to be much more expected the other case.

But, that again becomes a selection issue should we take a thicker belt, which will have less vibrations, but you still have to bend and you cannot obviously, think of taking the making the belt floating area very large, it has to be small because there are so many spindle which are deflated and the twisting has to happen so the small belts small things. So, that is one and vibration can also cause one of this temperature rise, the other is might just have one of the edges of the belt may touch the other edge of the other belt, which are moving in different directions. In ideal situation the belts do not touch each other they touch only the yarn, but what is the diameter of a yarn? A 40 denier yarn what is the diameter of the yarn? So, you actually cutting very close and if there is a vibration you can always touch.

So, one always has to worry about what will be the thickness, thickness with mean rigidity, rigidity means more temperature, less vibrations and vice versa. So, you have to look at these kinds of parameters, because they are going to be flexible, but no doubt it is a step much ahead in the friction texturing. If, you control these things you will have much more versatility of the machine that you can go for higher denier, lower denier, finer denier, then micro fine denier, type of yarn for texturing.

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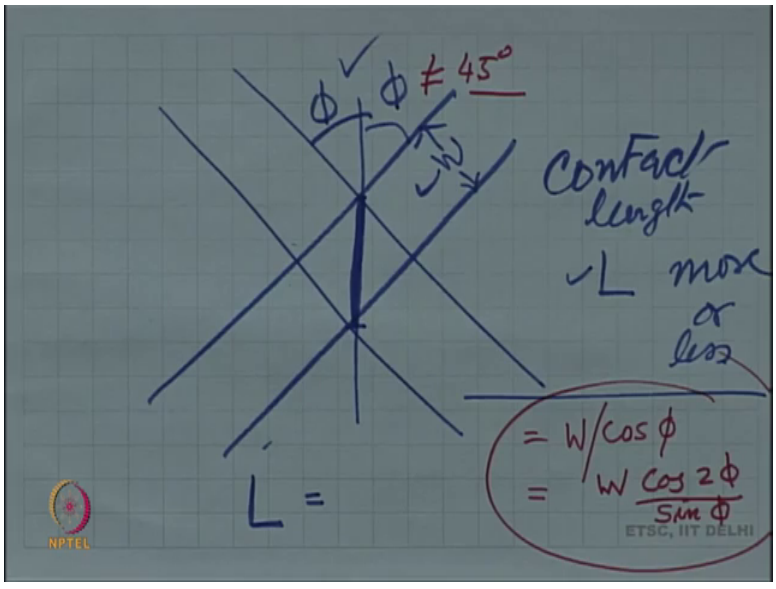

So then, so the yarn is not touching the belt at one point, it is moving across the contact length, let us say L. If, the contact length is more or less will it affect if it is a point contact you should have a belt some wires are running and between the yarn is running,

versus you have a belt, which has got a width so, it is easy to understand that this will provide a better nip and a better contact and less slip and so at some pair this L itself maybe a parameter which everybody may not be able to change, but the people are making the belts can be able to change, they can change. If, this is your phi and this is the width of the belt hoping the width of the both the belts are same and this is also phi. So, what should be the value or the expression for L, in terms of this and this can you give me that, I like to have some values, some expression can you give me that.

Student: W by sin phi l equals W by cos phi.

All right so whatever you give me I will right down ok. So, what did you say L is equal to?

Student: W by cos phi.

W

Student: (Refer Time: 34:41) W.

I have not heard.

Student: (Refer Time: 34:43) equals to.

Cos phi

Student: (Refer Time: 34:47) cos phi I think.

W upon cos phi.

Student: yeah it was sin phi.

Anyone else.

Student: Not cos phi W cos 2 sin divided by sin phi.

W cos.

Student: 2 phi

2 phi divided by.

Student: sin phi

Sin phi quite complex.

Student:

Tough right, one thing we can assume not assume you must expect the phi is not necessarily equal to 45 degrees, why should it be it is a flexible variable. So, I am not accepting any of these values, you can go back and keep it in your notebooks secure and safe the expression.

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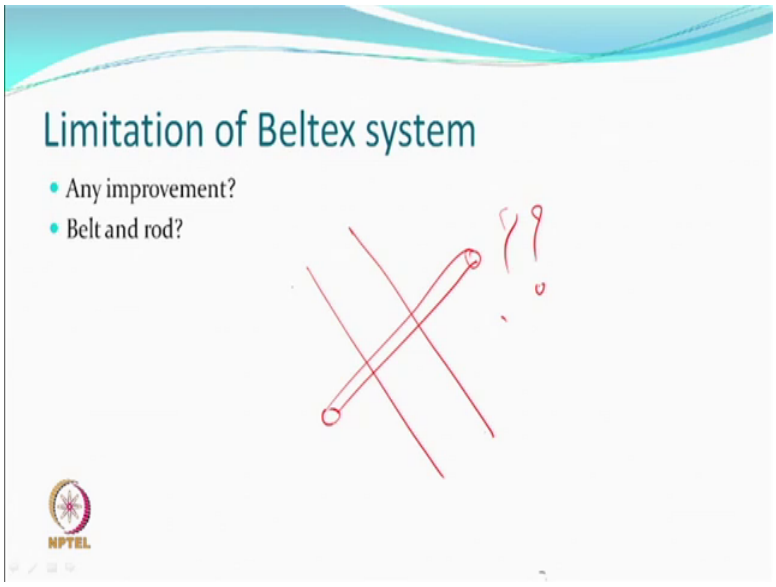

So, it is a beautiful system where some of the problems of the friction texturing older disc texturing friction disc texturing were handled pretty nicely, but the limitation would be the vibration and the temperature rise and therefore, there can be abrasion of the belt also and maybe the frictional properties change with time and temperature and so either you will keep replacing the belt as quickly as possible and what the belt will you belt probably would have one surface, which is the friction surface, other is supporting composite structure which has the textile. So, top surface maybe let us say polyurethane surface similar that or there is a composite flexible composite which; obviously, can move. So, how do you reduce the flexibility? So, some people suggested you see this is what is called thinking and keep developing things. Can we have one belt and the other a

rigid rod, which moves; rotates. So, it will create a nip of a different kind, but yarn can be in between.

So, you have a belt and you can probably consider having rod, which provides a nip can we have. So, this is just an idea, you can think about why we talking about like that? That if you can reduce the vibrations, I have similar things happening similar things not the same, then maybe you could reduce the thing the vibration. So, people did think about such kind of elements also, but not necessarily they were successful, but I leave it to you to also design any system, where you can think of, where you will reduce the vibrations using a belt and provide a nip; and provide a nip all right any system ok.

We go little further while people thinking. So, this thing that we are discussing now, that is not going to be your solution, your solution will be different. So, people also thought about another system, which we call the ringtex instead of a belt. So, instead of using a belt they said we can use ring and what is the system would that there is a ring, a pair of rings.

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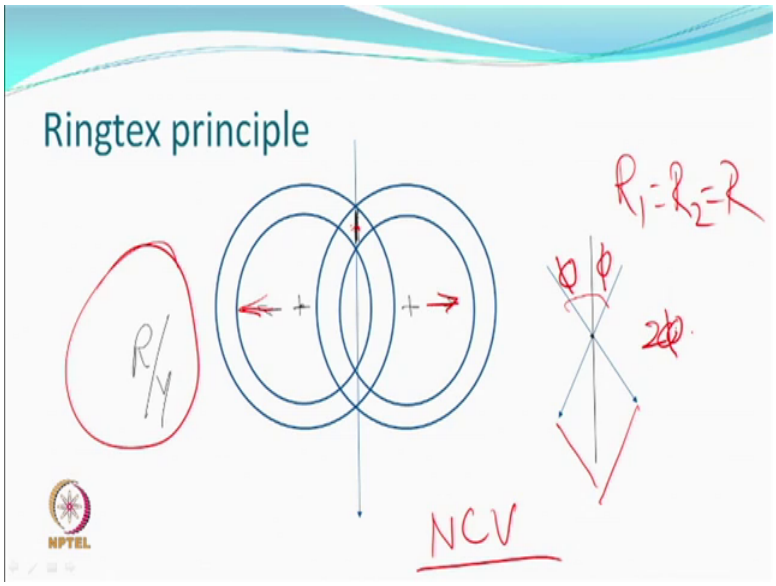

If, the pair of rings contact they can also provide at some point forces of this nature and they said this system is better. We can make it rigid and what else can you do? Instead of the belt moving in this angle, we can change this angle by just changing the overlap between the rings. If, we change the overlap, move this ring to this side, this ring to the other side, you will see this angle will change you believe that.

So, they said our system is better than the beltex, why is it better? Because when you change the angle the whole drive assembly has to change it is position right. So, belt has to be driven something driving the belt. So, that position also you must change. Of course, you can change and they said we can change, but that is more complex we say this is simple just in the same line, you change the centre of the disc your angle will change. As far as the speed of the ring is concerned they are rotating, at that point what was the speed, that can be changed and if you are synchronized both the belts both the rings will move with the same speed, which could be let us say R 1 is equal to R 2 is equal to R and you can have a concept of yarn moving R by Y, the question that may be interesting to ask at this point is how do you move a ring?

The belt have to you know drive mechanisms one may be positively driven other may be just following it or both of them could be positively driven, how do you rotate rings. I leave this at this point just for you to think that there is another principle, which is also nip controlled vector drive principle, vector because you are having various directions of velocities and therefore, the frictional force and then you can change the crossing angle let us say this is also phi and this is also phi. So, you have 2 phi as the ring crossing angle at some point.

So, it has a control and there is a nip and everything else could be similar to the beltex system, but how do you rotate them. If you understand what is a ring it is not risk when you have to rotate. So, you can think about it when we meet next time, we can move further from here.