Theory of Yarn Structure
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Lecture - 11
Helical Model of Fibres in Yarns (contd.,)

Welcome to you all to this MOOC's online video course theory of yarn structure. We were discussing module 4 in the last two classes. Module 4 speaks on helical model of fibres in yarn. So in the last two classes, we tried to solve 3 problems on yarn structure under helical model. The first problem was associated to how to determine number of fibres present in yarn cross-section.

So that we have solved and then second problem was to explain the phenomenon of yarn retraction scientifically. So we developed and studied a theoretical model for that purpose and also third important how to find out limit of twisting theoretically, so that also we have solved. Then, we continued with one numerical problem that we learned in the last class. Today, we will learn two more numerical problems on module 4.

Then, however this module will be completed. So let us start with the numerical problem 2. So numerical problem 2 reads as follows, a cotton carded ring spun yarn of 29.5 tex count and 719.43 meter inverse twist is prepared. Estimate the retraction of the yarn right. So we have to estimate retraction of the yarn.

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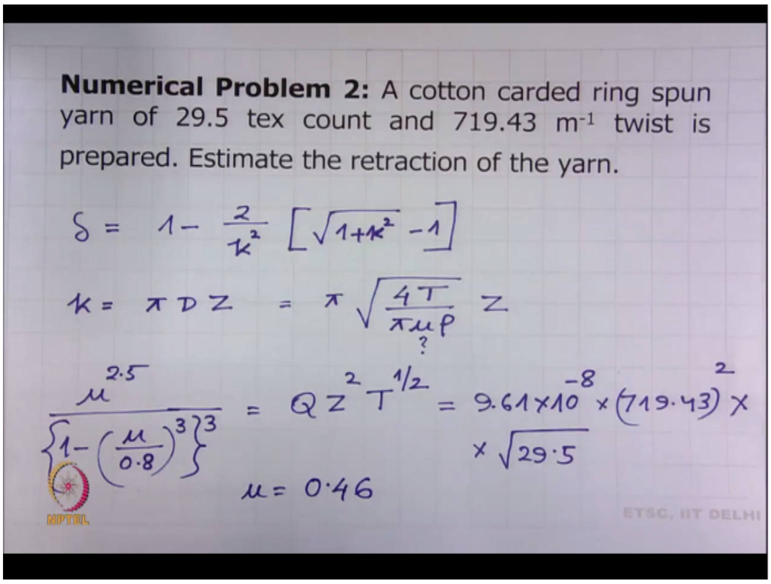

What is yarn retraction? Yarn retraction we have already learned in the previous class 1-2/k square 1+kappa square-1 right. So this is yarn retraction, this is kappa yarn twist intensity; this is also kappa yarn twist intensity. So we have to determine yarn twist intensity. Then, we will be able to solve the problem, pi D z okay. Twist is given 719.43, D is not given, so we need to calculate D, z pi is well on 3.14, capital T 29.5 tex is given, rho cotton fibre, so 1520 kg per meter cube, z is given, mu is not given.

Rest all are given, so we need to find out mu. How will you find out mu? You will use the formula learned in module 3. So cotton carded yarn 9.61*10 to the power -8, z is given 719.43 square and T is also given 29.5 (()) (04:32). So this we have already solved. You will find out if you solve mu is=0.46. So this mu you will substitute here.

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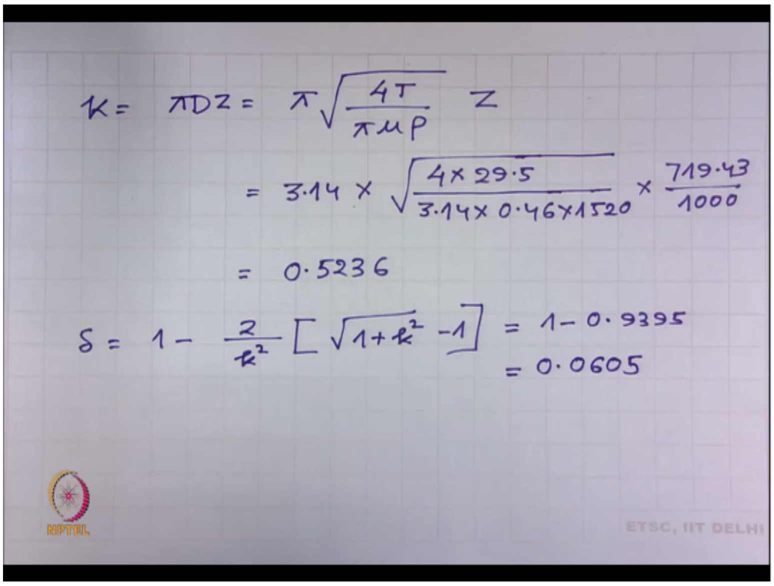

So then we will find out kappa 4 T is 29.5/3.14*mu we determined 0.46 and cotton fibre 1520 kg per meter cube. So this will give you in millimeter and then 719.43/1000 will also give you in millimeter inverse, so if you solve you will find out this value 0.5236 right. So if you know kappa, you will be able to determine yarn retraction 2/kappa square 1+kappa square-1. So you substitute this value of kappa, then you will find out the value will be 1-0.9395.

This will be equal to 0.0605, so 6.05% will be the retraction. So this is the answer. So what we did let me tell you once again. We know yarn retraction is equal to this expression where kappa is pi times D times z yarn twist intensity. Now what is D? D is square root of 4T/pi mu rho. Now in this expression capital T is given, rho is given, z is also given, mu is not given. So we determine mu from this expression that we learnt in module 3.

Q is given cotton carded ring spun yarn so 9.61*10 to the power -8, z is already given 719.43, T 29.5 so if you find out then you will solve for mu, you will get mu is=0.46. This mu is substituted here. So you substitute mu here and then finally obtain kappa, yarn twist intensity 0.5236 and then finally yarn retraction is 1-this so kappa you substitute you will get 0.0605 as the answer for yarn retraction right. Now the third problem is related to two terminologies. Let us tell you this.

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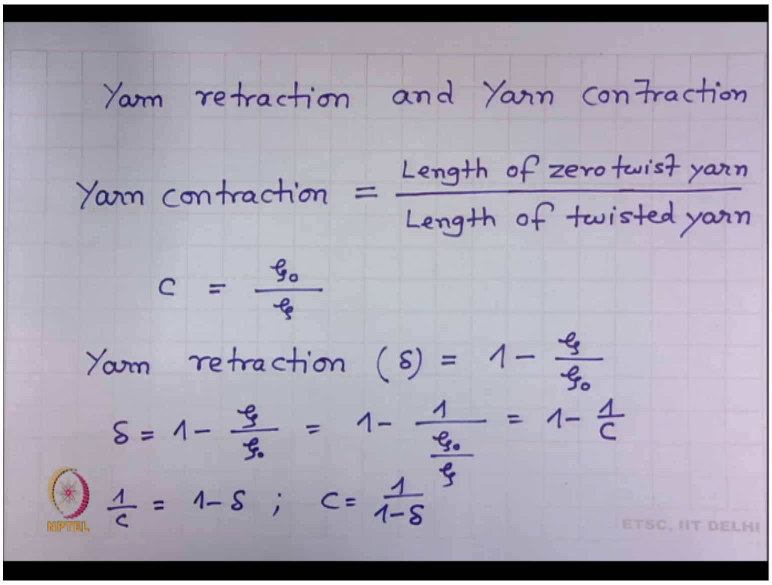

Yarn retraction and yarn contraction, actually what happens is that though we prefer the phrase yarn retraction, some authors prefer the phrase yarn contraction. They are not same but they are related. So let it be clarified what is yarn contraction and how is yarn contraction related to yarn retraction. Yarn contraction is defined by length of zero twist yarn/length of twisted yarn.

So let us use the symbol C for yarn retraction. Now if you go back to our symbolism in this module, length of zero twist yarn zeta 0 and length of twisted yarn zeta. So as per this definition, yarn contraction is related to this and what is yarn retraction. Yarn retraction is 1-final length/original length right. So what is the relation between yarn retraction and yarn contraction?

So this is the relation between yarn retraction and yarn contraction. Let us write it in some other form. So yarn contraction is=1/1-yarn retraction right. Now we come back to our problem 3.

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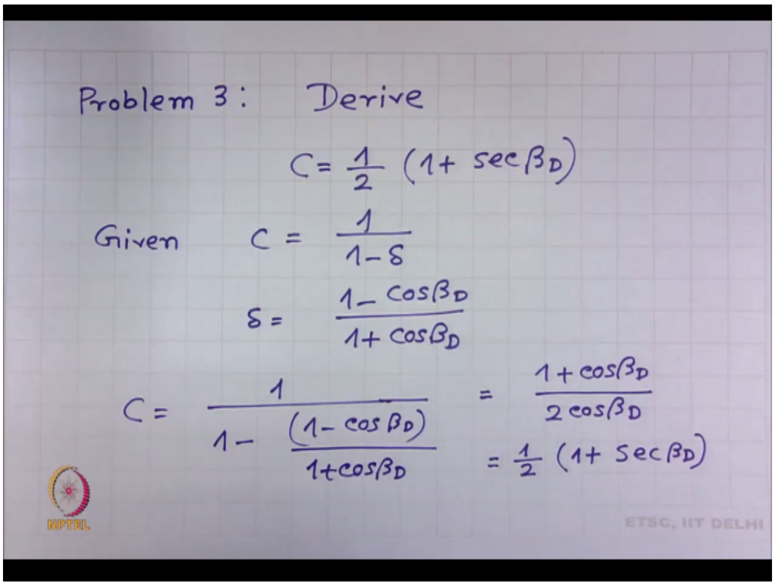

Derive C is equal to this. What you know, given by now you know that C is equal to this and also what you know is not it? So what do you do? Let us substitute delta in this expression. So C=1/1-1-cos beta D/1+cos beta D, so 1+cos beta D/2 cos beta D right, so this 1/2*1+1/cos beta D sec beta D clear. So this problem 3 was basically to understand the relationship between yarn contraction and yarn retraction.

Why we need to understand because although in this module we preferred yarn retraction; however, many authors in many books use the term yarn contraction. So it is necessary for us to also learn yarn contraction and their relationship. Now yarn contraction is defined by length of zero twist yarn/length of twisted yarn. So there is as per our symbolism capital C yarn contraction=zeta 0/zeta.

Now we know yarn retraction is 1-zeta/zeta 0. So if you substitute then finally we obtain yarn contraction is=1/1-yarn retraction. Then, we solved the problem number 3, derived this expression. We know C is equal to this and delta is equal to this. Then, by substitution we can obtain C is equal to this, so this is the answer to this problem alright. So we have solved 3 problems in this module and this module 4 ends here. Thank you for your attention.