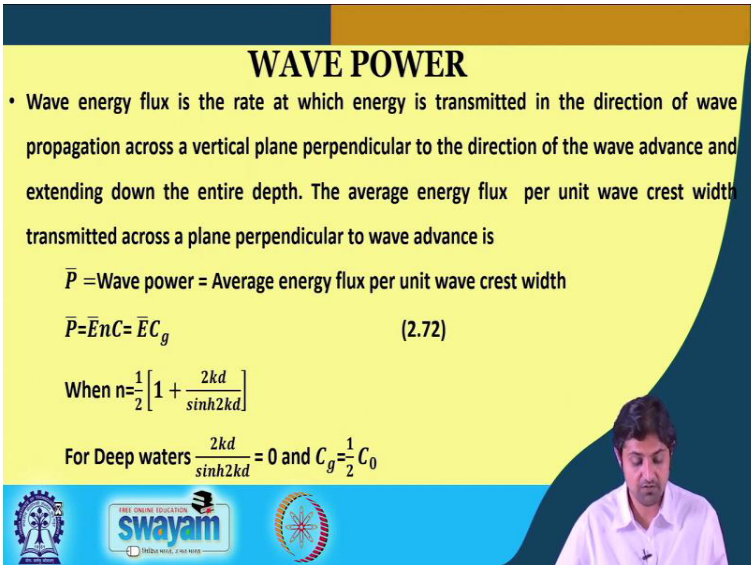

So, now we have studied wave energy it is very obvious that we study wave power wave energy flux is the rate at which energy is transmitted in the direction of wave propagation across a vertical plane perpendicular to the direction of wave advance and extending down the entire. So, the average energy flux per unit wave crest with transmitted across the plane perpendicular to the wave advances is wave power. And it is given as e into CG.

This is important CG is group velocity and e is the energy that we just derived. So, the power is given as e into CG or in if you want to write it in terms of celerity. It is e bar n into CG u did you saw that n was this so, the wave power is nothing you reject. You just need to remember the formulas e bar into CG where e bar was gamma a Squared by 2. So, for deep water you know that CG was half c not.

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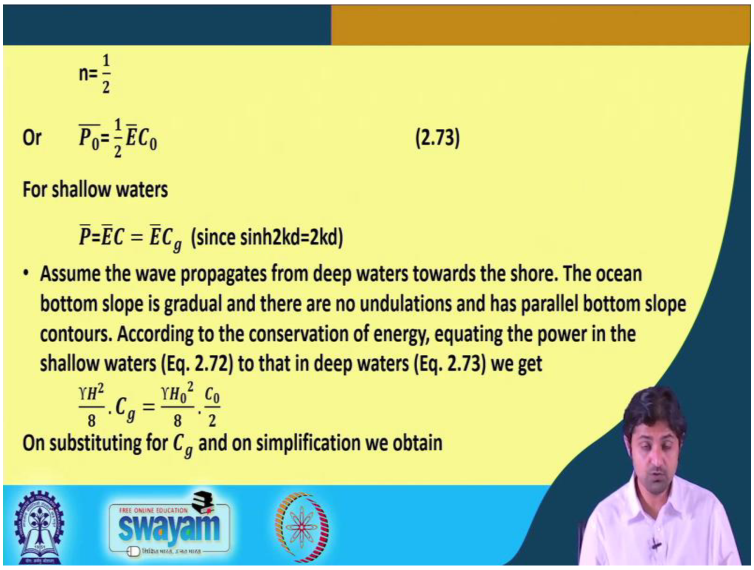

n = half so, power is going to be half into C not for shallow water it will e into CG because CG is C only if you assume that the wave propagates from deep water towards the shore and the ocean bottom slope is gradual and there are no undulations and as parallel bottom slope because, you see the wave power is going to be conserved if the wave moves from 1 depth to the other. Because you see this if there is no loss, it is average energy flux per unit wave crest rate.

And if we apply the conservation of wave power. So, you see this is any depth. So, e is gamma a Squared by 2 = gamma is h by 2 whole squared by 2. So, this becomes gamma h squared by 8 and CG V not. So, with the wave propagates from deep water to let us say any depth whether intermediate or shallow. So, wave power is going to be conserved correct. So, in deep water, it will be gamma h not squared by 8 h not indicates the wave height in deep water.

multiplied by we have already seen that this is going CG is C not by 2 and this will be equal to gamma h squared by 8 this is the way high at any depth where we want to calculate multiplied by CG, this is what this equation is all about this equation so we are conserving power from deep water to any water depth. And if we substitute for CG as C by 2 into 1 + 2 kd by sin h2kd.

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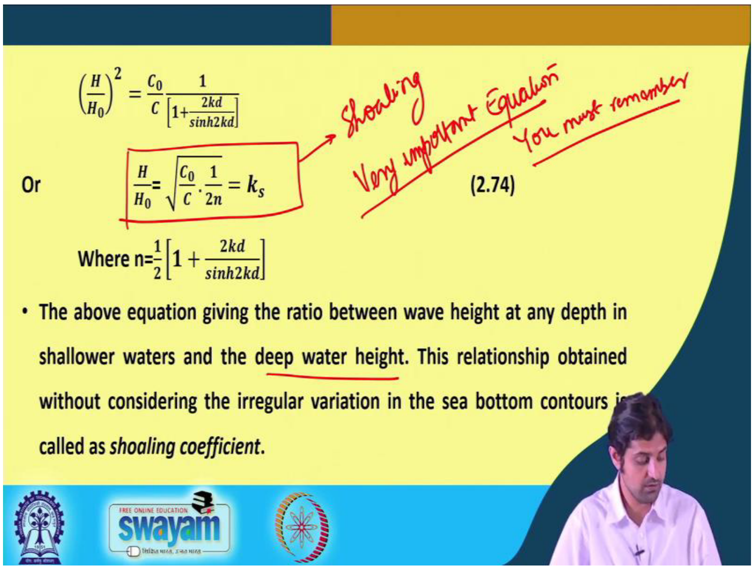

We are going to obtain h by h not = C not by C into 1 by 1 + 2 kd divided by sin 2hkd or we can obtain h by h not = under route of because this is n this is n by I mean this is a 2n. Therefore, h by h not = under or under route of C not by C into 1 by 2 n this is called Ks where n = half into 1 + 2 k d divided by sin h2kd. So, the above equation is very important again this represents of phenomena which is called shoaling. And this gives the ratio between wave height at any depth in the shallower waters compared to the deep water wave height.

And this relationship is obtained without considering the irregular variation in the sea bottom. And this ratios under root of C not by C into 1 by 2 n is called shoaling coefficient or chaos. So, until now, you saw that we had been able to obtain relationship between the water velocities and only kinematics, but this is the only equation that we have studied that if we know the wave height in deep water we will also be able to calculate the height it any depth to z.

So, a very important equation which you must remember the shoaling coefficient and the root C not by C into 1 by and where C not is the, speed in the deep water which is 1.56 times t. So, there are some, you know formulas to remember, but, remember only the simple ones, the ones that I have already told you. So, by equating the wave power, we have been able to obtain the wave height the wave height transformation if the wave propagates from 1 depth to the other depth.

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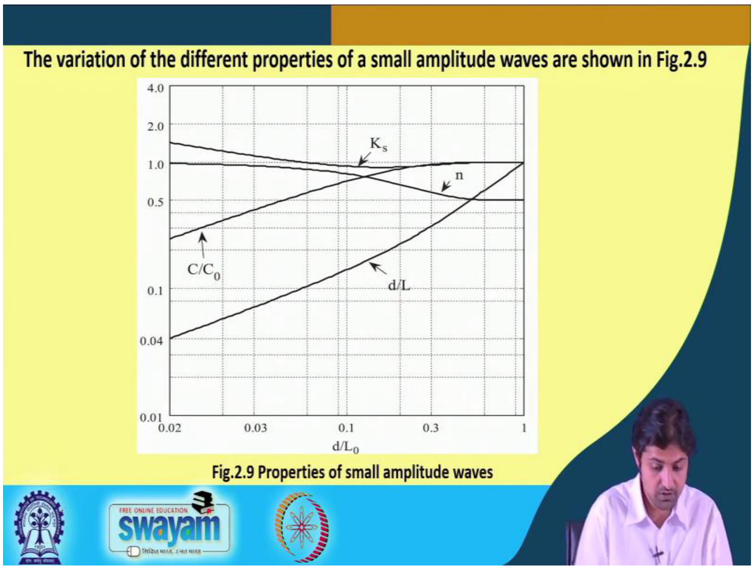

Fig.2.9 Properties of small amplitude waves

So, the variation of different properties of a small amplitude waves are shown in this figure you do not need to pay too much attention just we have plotted d by L C by C not k s and n which you already know chaos is the shoaling coefficient.

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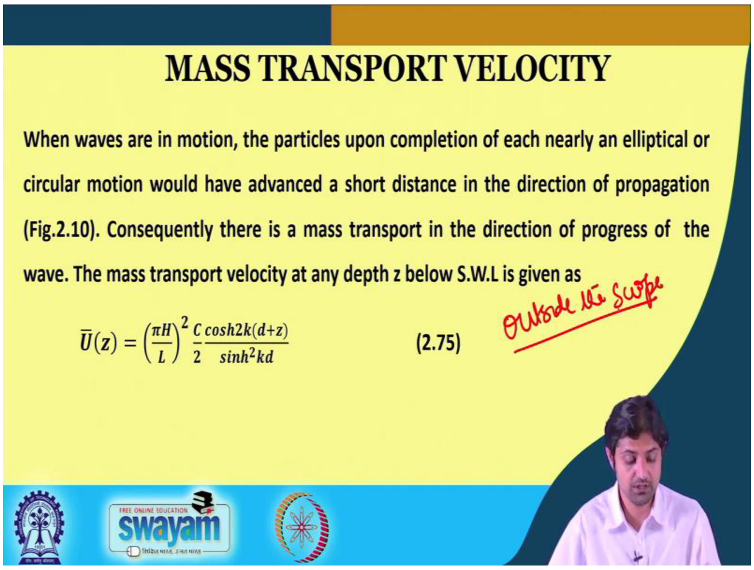

So, this is the last topic the derivation is outside the scope, but what you must understand is that when waves are in motion, the particles upon completion of each nearly an elliptical or circular motion would have an advanced a short distance in the direction of propagation of waves, you can check it from those equations as well. Therefore, if they move ahead that means that the mass associated with them has already moved forward correct. This mass transport is happening in the direction of the progress of the wave.

And the mass transport velocity is given by phi h by L whole squared into C by 2 cos h2kd + z divided by sin h squared kd. So, this is outside the scope formula I do not expect you to you know, remember this particular equation, but more importantly the message is to convey messages that you must understand that the mass transport happens and then the wave motion is there. Of course, you must remember that it is a function of edgy Squared for example, mass transport is the function of h squared or you know is related to how I mean the end of the vein which is proportional to one quantity.

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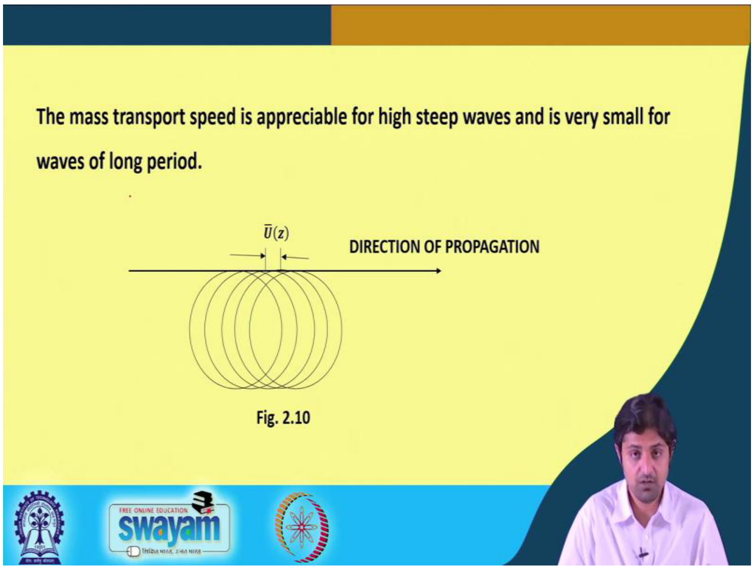

So, the mass transport speed is appreciable for high steep waves and very small for waves of long period you can see this equation. So, if it is a long wave, the mass transport is very less because, so if period is long the length is long. It is the high steep wave which means which is directly proportional to h squared. So, the mass transport will be high for long the higher waves.

So, this was the last topic of hydraulic engineering which we have finished now, and with this I would like to close the lecture and also this course. If you have further doubts, please do contact us and the forum or I will be appearing in some live sessions. Also, I do not know if you have something after the this lecture, but if you have you can send email to my teaching assistants, or also post the question and forum. I wish you good luck for you are assignment for this particular week. And also the final exams. Thank you so much for listening. Have a great year.