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Theory and Practice of Non Destructive Testing

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Ultrasonic Testing - 9

Hi everyone we are on this topic of ultrasonic testing and in the last class we have discussed a very important aspect of this particular technique which is calibrating the instrument because as I said when the indications are indirect you need to calibrate the instrument so that you do not end up with erroneous results or you know whatever observations you make those are correct okay so in order to ensure that you need to calibrate the instrument and for this particular technique we saw in the last class that the two main things that you need to calibrate for a normal probe our distance amplitude the calibration and area amplitude calibration okay.

So these are the two things that we saw in the last class but in certain cases as I would have said before also you need to use an angle probe all so far whatever we have discussed for the calibration it was for a normal probe and in today's class now we are going to see how to calibrate an angle probe okay.

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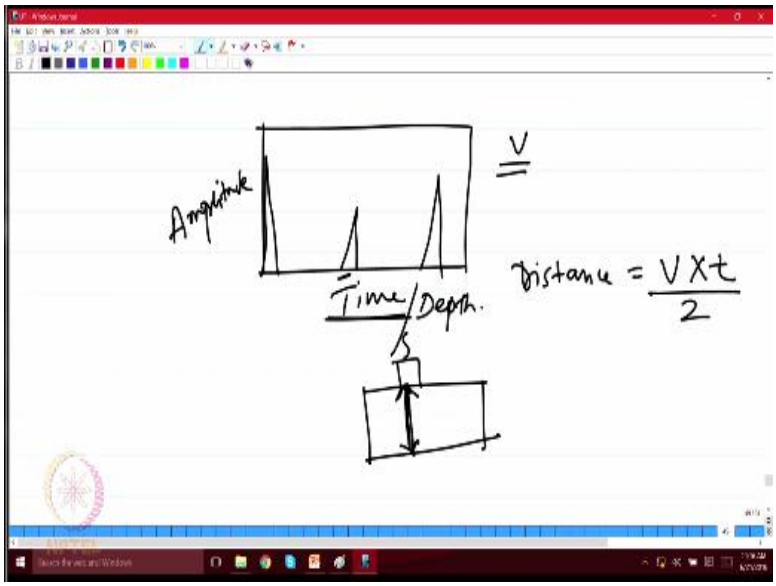

So in order to do that you need to use different type of block okay.

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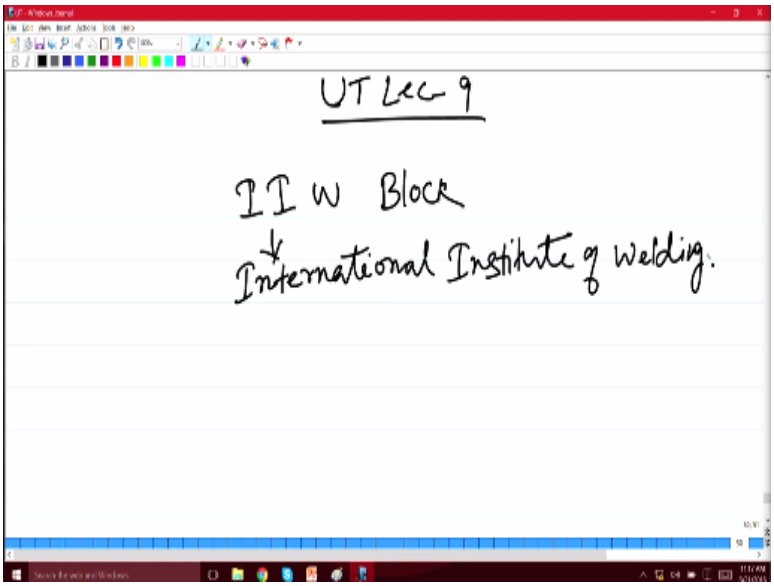

And this block is quite versatile in the sense it can not only do calibration for the angle but it can also calibrate normal probes as well okay and there are a few more things that you can do using this particular block as we are going to discuss today okay so this block is known as IIW block and this IIW stands for international institute of welding so this block is specified by them this institute.

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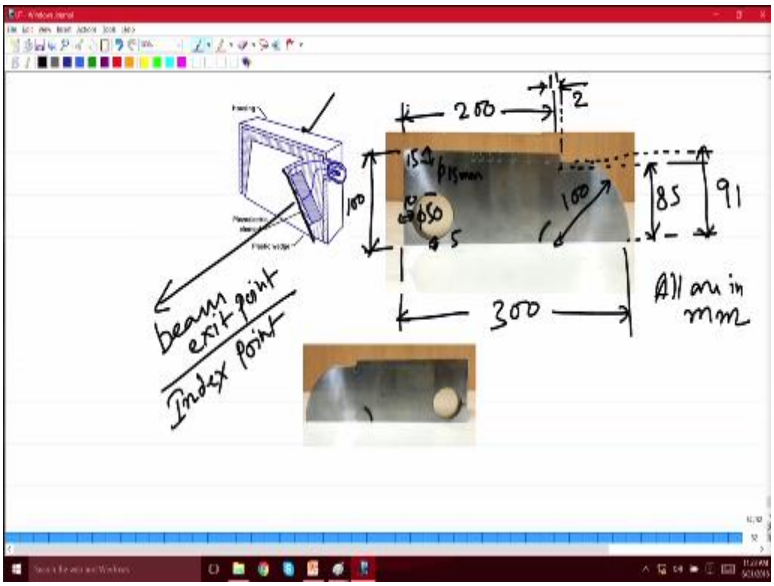

So if you see the block it looks something like this okay so let us say you have this kind of angle probes this you have seen before also and you need to calibrate it for the angle and a few more things as we are going to see and for that this is the IIW block which is used okay so this is the block let me magnify a bit so that you can see it clearly okay so this is how it looks like ok so it is a block made of steel and there are few features on this block and with the help of these features we can calibrate an ultrasonic transducer and the instrument okay.

If you look at the dimensions these dimensions are something in this range the typical dimensions if you see this length is 200 and you have a notch over here as you could see which is 2mm so all these dimensions I am writing in terms of millimeter this radius is 100 mm and the height is also 100 there is a hole over here as you could see in this particular location okay so it is a small hole the diameter of which is 1.5 millimeter and it is at a distance of 15mm from the top okay and you have a bigger hole over here okay.

So this is a 50 mm diameter hole and from this end it is five and from the other side it is 10 mm okay and the total length of this whole thing is around 300 mm okay so these are the typical dimensions of this particular block and now you could see there are several features on this the

first one you could you can see there is a curvature over here this 100mm radius curvature then as I said there are two holes one over here which is 1.5millimeter okay and then the other one a bigger hole which is a through hole this is 50 mm in diameter okay.

So let us see how this can be used to calibrate angle probes okay so this is an angle probe which is shown over here you have seen it before also and you have seen this plastic wage has been cut over here to provide that particular angle that you need okay so the first thing that you need to know for this kind of angle probes is on from this surface where exactly the beam is exiting so we exactly is the beam exit point because the angle has to be calculated with respect to that particular point okay.

So there is a surface here and you do not really know as to what exactly is the exit point so first thing that you need to do you need to find out that exit point okay then only you can talk about the angle because as I said the angle is measured with respect to the index point okay so this is the beam exit point is also known as the index point and that is the first thing that you need to find out okay.

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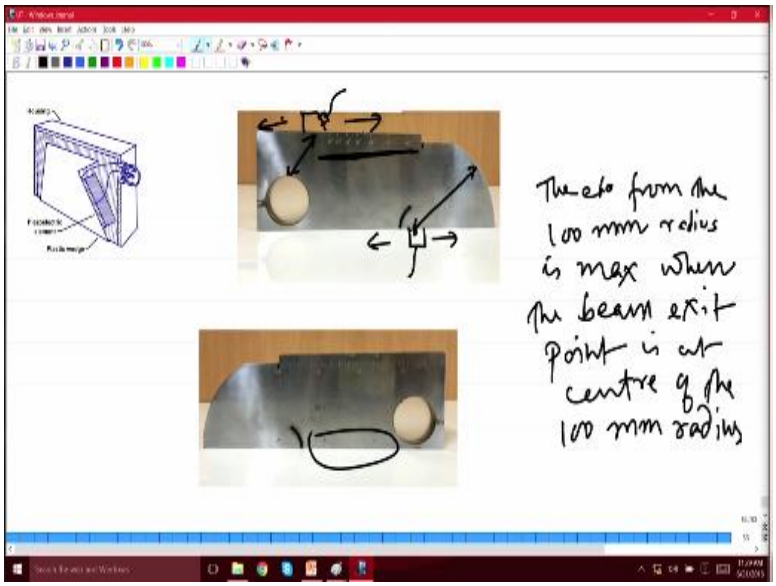

So in order to find the index point you have to keep the probe on this surface somewhere here and hit this curvature and get an eco from there okay so this eco from this curvature will be maximum when the probe is exactly on the center of this curvature so when the beam exit point is at the center of this curvature you get a maximum signal so what do you do you take this probe and then move it on either side like this till you get a maximum signal okay so the moment you get the maximum signal you stop there and you mark that point so there could be a marking on the block also which is the center of this 100 mm radius so that you mark on the probe as the index point or the beam exit point right.

So in some of the probe so you can already see that this index point is being marked okay right on the flow okay so if that is there that will be your index point and you can match it by this particular method and if it is not there then you should mark it like how I said okay getting a maximum signal from the 100mm radius and then at that particular point you mark the index point on the transducer probe okay so that is the first thing you do and then you go on to calibrate the angle and other things okay.

So let us see how you calibrate the angle using this particular probe okay so in order to calibrate the angle if you look here on this part there is a scale graduated on this on the block okay so that is the scale for the angles you can see there are several angles which are marked there like 45 degree and 60 degree and so on okay similarly on the other side also on the bottom also you could see here also you could see along this area here also you could see there are some angles which are graduated which are marked on this surface.

So you using these angle scales you would be able to see what exactly is the angle of the ultra sonic beam which is coming out from an angle flow okay so in order to do that what you can do you can keep the probe over here on this place okay and then get an eco from this 50 mm diameter hole okay so what you do you move this probe on either side like this again.

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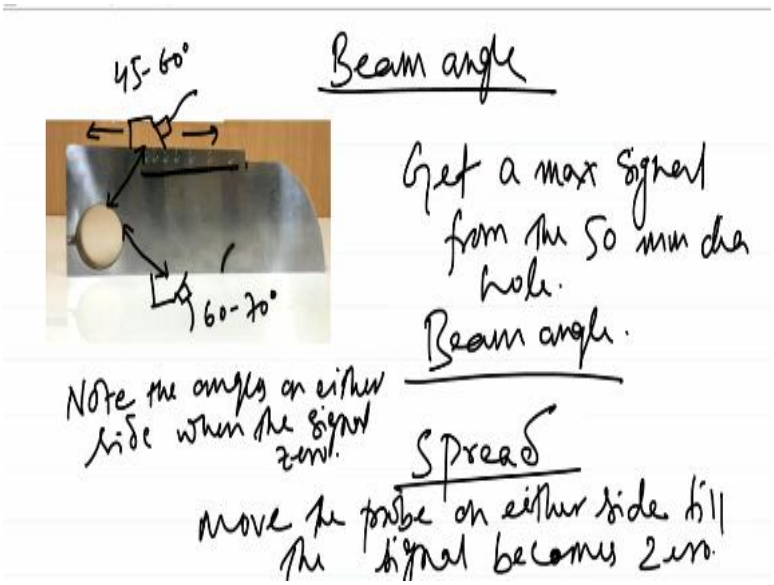

So let us find out the beam angle from this yeah so you as I said you're keep the probe on this surface and get an eco from this 50 mm diameter hole okay and what you do you move the probe on either side like this and get a maximum signal from the 50 mm diameter hole so when you get the maximum signal you stop it at that point and then see from this scale that the index point of this probe is matching with what angle okay.

So that will be the beam angle okay so this is how you find out the beam angle first so this top surface that you have if you keep it over here this can be used for angles in the range of 45 to 60 degree and for higher angles you could keep the probe over here on this surface okay so this will be 60 to 70 degree because if you have seen the angle so the higher angles are on the lower side and on the top side this is the range okay so this is how you first get to know the angle okay once you have established the index point you get the beam angle but a beam angle we will also have a spread beam spread okay.

So this spread also you need to find out as to how much in the spread in the angle so what you do once you establish this angle and the corresponding point for the maximum signal you move this probe again on both the sides from that point of maximum signal so first you move for example

towards the left till the signal becomes zero, so move it on either side till the eco becomes zero okay, so first you move it on the left-hand side and then see at what point it is becoming 0 so note down the angle when it is 0 and the difference of these two angles on either sides will give you the beam spread okay.

So first moved left and then see at what point it is becoming 0 note down that angle and then you go to the other side till the time it again becomes zero so note that angle also take a difference of these two angles and that will give you the beam spread okay so this is how you find out the beam angle and the being spread by using this high w block okay then there are a few other things as I told in the beginning that you can do by using this block apart from finding the beam angle. So let us see what are the other useful things that we can do by using this particular block.

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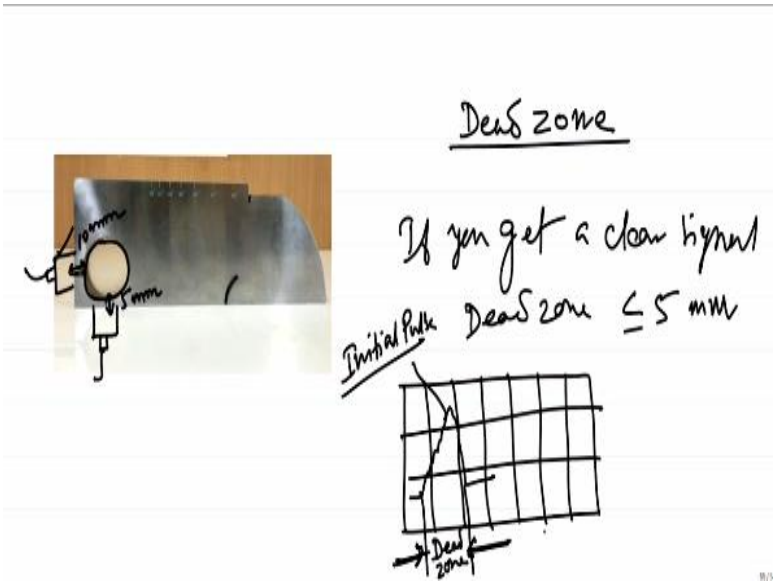

One very important aspect as you have discussed before also particularly for closed surface analysis by ultrasonic testing is the dead zone so you should have some idea about the dead zone for a particular transducer which is used for you know closed surface kind of analysis that again can be found from this block and again you can use this 50 mm diameter hole so what you do you keep the probe at this point first and you know this particular distance is 5mm right.

So from this location if you get a clear signal from the 50 mm diameter hole okay then it will indicate that the dead zone is within 5 mm or less than 5 mm because you will you are getting a signal from a 5mm distance by utilizing that particular probe so that will indicate that the dead zone is less than 500 okay if you do not get a clear signal from this side then you can put the probe over here and you know in this case this particular distance is 10 mm.

So if you get a signal from 10 mm distance but not from 5 mm then that will indicate that the dead zone is between 5 mm and 10 mm okay on the other hand if you do not get any signal from this a 10mm distance also then it will indicate that the dead zone is more than 10 mm okay so this is how you can get an idea about the dead zone also from this IW block okay I should also tell you at this point this dead zone some idea about the dead zone can be obtained from the display as well.

From the initial pulse that you have okay so the initial pulse let us say if it will it might look like this okay so the width of this initial pulse will give you an idea of the extent of the dead zone for that particular probe using which you have obtained this initial pulse okay because within this particular distance you do not see anything apart from the initial pulse you do not see any other Eco right.

So that means within this distance the probe is not receiving any equal it is not able to receive in eco within this distance and that is why that particular distance or the width of this initial pulse will indicate the size of the dead zone for that particular flow okay.

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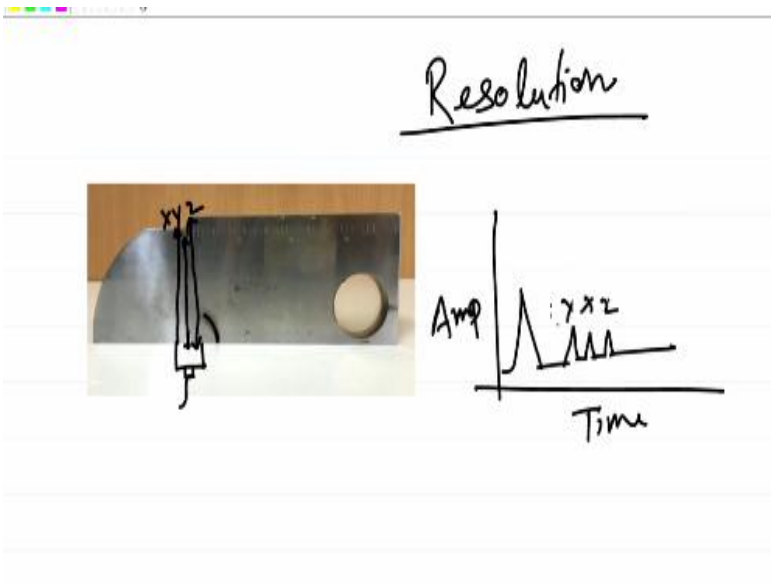

We will see one more important aspect one more important thing which can be found again by this I w block which is the resolution of any ultrasonic probe okay resolution means if you have two closely spaced defect lying very close to each other then you should be able to get at two different eco from this closely spaced defects instead of getting a single peak or two peaks Mass together into one okay.

So if you get that two separate eco from these two defects which are lying very close to each other then you say that the resolution of that particular probe is good on the other hand if you do not get at two separate echoes from these two defects then you say that there solution is not good okay so with the help of this particular notch that you have over here okay you would be able to find out whether the resolution for that particular probe is good or not okay.

And this we know it is a 2 mm wide notch so what you do you place the probe on this surface let me use this okay so what you do you place the probe over here on this surface and then get course from this notch from three different points like first you get an eco from this and then right from the root of the notch like this and then again from the other side of the notch, okay so let us call these points as x y and z.

So you can see these points are very closely lying to each other within2 mm okay so if the resolution of the probe is good then you should be able to see three different eco with respect to these three points like this okay y x and z and if you are if the resolution is not good then you will see that you are not getting three different eco from these three different points okay, so this is how this IW block is also useful for finding other important parameters like the reservation.

And also you would be able to get some idea about the sensitivity and things like that okay, so this was about calibrating angle probes by using this IIW block.

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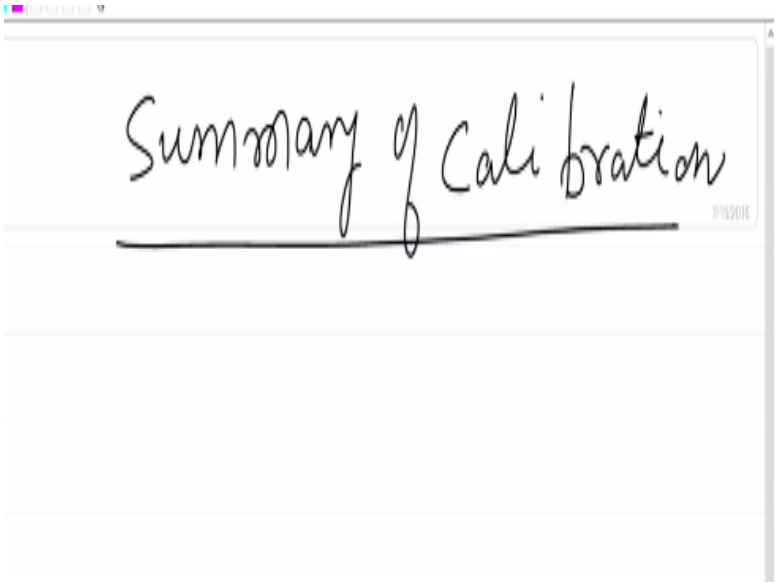

Since we have been talking about a calibration in last few classes so it will be good to summarize this particular process of calibration so let us do that.

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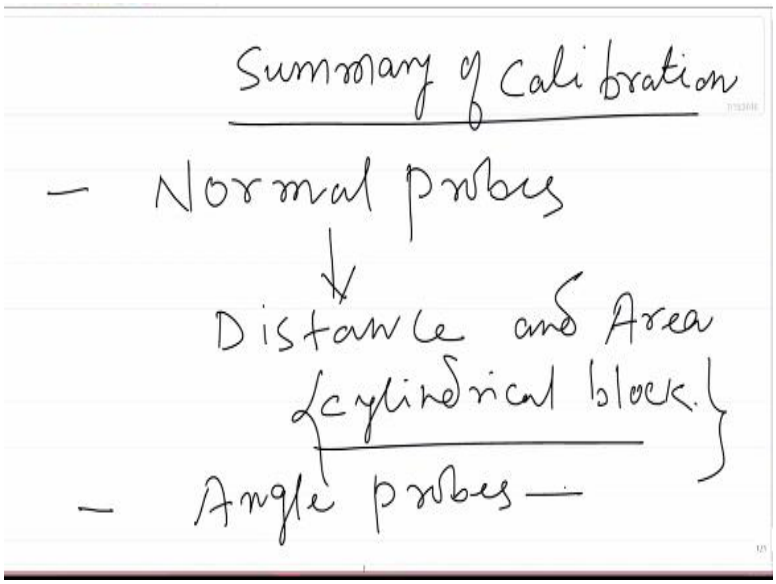

Before I close today so in case of normal probes we saw that you can calibrate the distance and the area and in this case a cylindrical block was used and this block had a flat bottom hole at the bottom of the cylinder and a particular metal distance so in case of distance calibration the metal distance was varied and in case of area calibration the area of the hole was varied okay so that is how you get different distances in one case when you vary the metal distance to calibrate the distance and in the case of area calibration you vary the size or the area of the hole and that is how you get different areas to calibrate in terms of area so that was about calibrating normal probes and when you have angle probes there we saw that you could use a block which is known as IW block.

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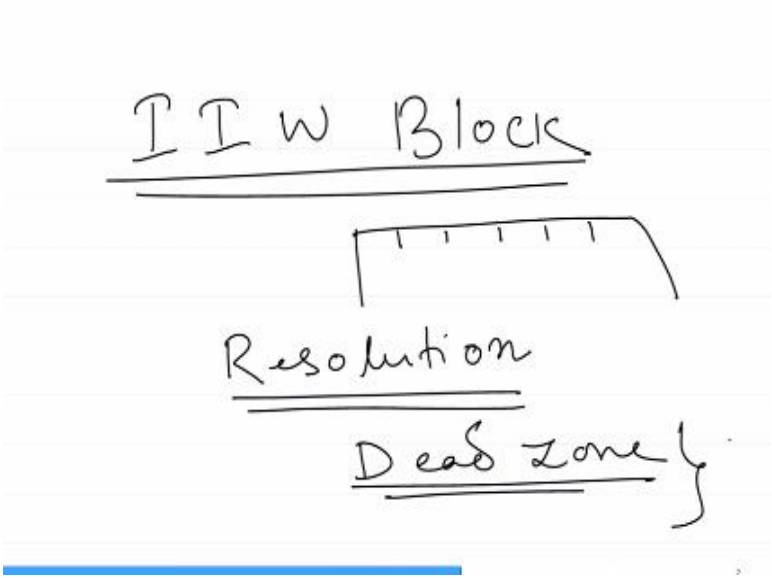

And in this block we have several types of features which can be used to calibrate the angle for a particular angular transducer and on the on the block we also had this angle scale graduated and with the help of that we could calibrate the angle and apart from this we also saw that this IW block is quite versatile in the sense that apart from calibrating the instrument or the probe for the angle it can also do certain other things.

For example it is very useful for getting an idea about the resolution of a particular probe okay so that also can be done using this particular block and then we also saw that you can also get an idea about the dead zone by using the 50 mm diameter hole that you had in this block so this is another thing that can be determined from IW block and that is why as I said this is a very versatile reference block which can be used not only for calibrating the distance of the angle.

But it can also be used for getting this important parameters like the resolution dead zone and in fact you would also be able to get some idea about the sensitivity, okay so these are the different things that can be done with the help of the IW block okay so finally what we have for calibration.

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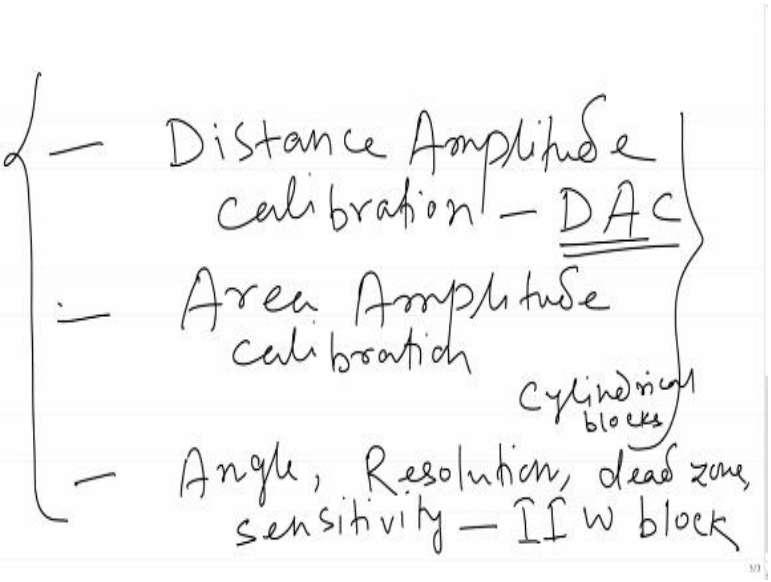

We need distance amplitude the calibration it is also known as distance amplitude correction our DAC we did the area amplitude calibration these two with the help of cylindrical reference blocks and for calibrating the angle and getting to know about resolution dead zone and sensitivity this IW block can be used okay so this is how the whole process of calibration is done in order to ensure that before you do the test the instrument and the probe is calibrated and you do not end up with any erroneous results okay right, so this is all I will have for today and in the next class we will see a couple of more important aspects for this particular technique so I am going to stop here today and I will see you next time thank you.

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