Fundamentals of Power Electronics
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Lecture – 23
Three-phase rectifier capacitor filter

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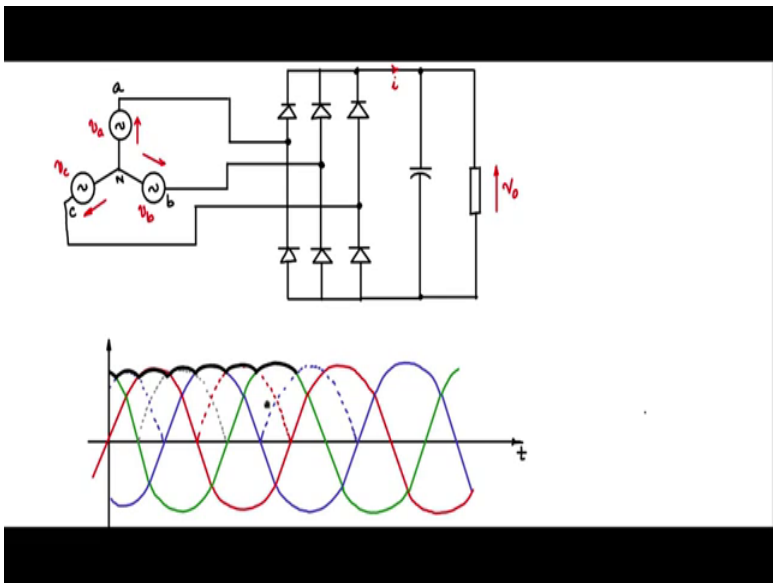

For three-phase AC to DC applications you have the three-phase rectifier capacitor filter circuit. It is very similar to the single phase rectifier capacitor filter circuit, except that we need to had one more arm to account for all the three-phases.

Now, let us take the sources three sources, v a, v b, v c they are star connected in this fashion the neutral and these three line voltages you bring it out and let us connect it to the diode bridge. Now, you have a three-phase diode bridge one for each phase and connect the phases in this manner, then output of the diode rectifier you connect the capacitor and then the load resistor. So, this a b c this will be v a, v b, v c, let us say measured in this fashion, this v naught and i. Except for the addition of this extra diode bridge and three-phase supply rest remains the same.

Let us look at the waveforms of this current and the output voltage to understand the three-phase rectifier capacitor filter operation. Let us now draw the wave forms for the three supply voltages and see how the ripple voltage waveform at the output would look like for a three-phase rectifier capacitor filter circuit.

Now, let us draw the x axis, the x axis is t and let us now draw the three-phase wave forms. I will draw in this fashion you will know that three-phase wave form drawing is difficult, but doing it this way will make it at simpler. Yes, now this is the a b c, a b c, so on and now when it passes through the rectifier at this node, across this node if capacitor were not there you will see that this will rectifier for the this will be rectified wave form fold back.

So, I will show that in dotted. So, you will see that these will get rectified this bottom portions will get rectified in this fashion. And then look at this envelope. This is the envelope that you would see here and this envelope you obtain even without the c filter. So, this would give you 13.3 percent rectifier.

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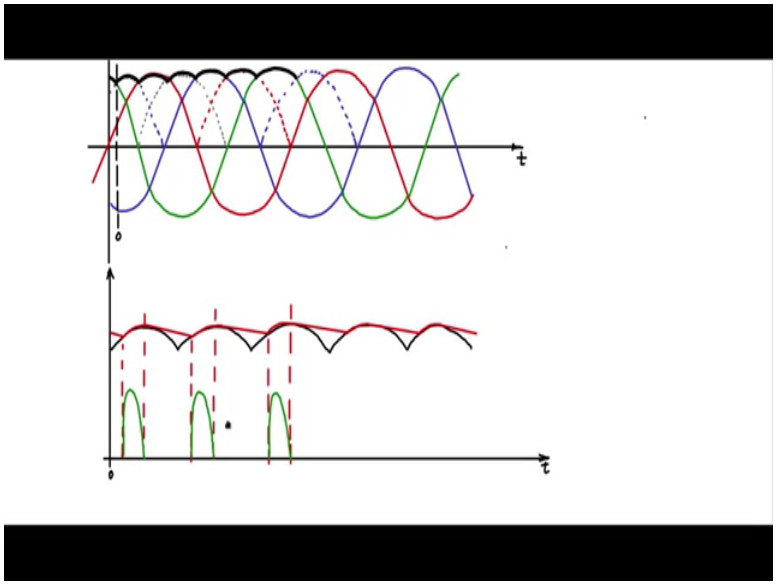

Now, this if I zoom I should be able to I will take this as the reference 0, and then with respect to that I will zoom this, and the output wave shape will be something like that. Similar concept, where in steady state at this point let us say the diode conducts, the output voltage tracks the input envelope and then discharges. At this point tracks the input envelope and once the input envelope goes below the output diodes are reverse biased and the capacitor discharges, so on, this continues.

Now, this would be the conduction times whenever they tract the input envelope, and if you draw the verticals you will see the current wave shapes will look something like that. The current wave shape, this current wave shape is at this point.