Fundamentals of Power Electronics
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Lecture - 25
Power factor - motivation

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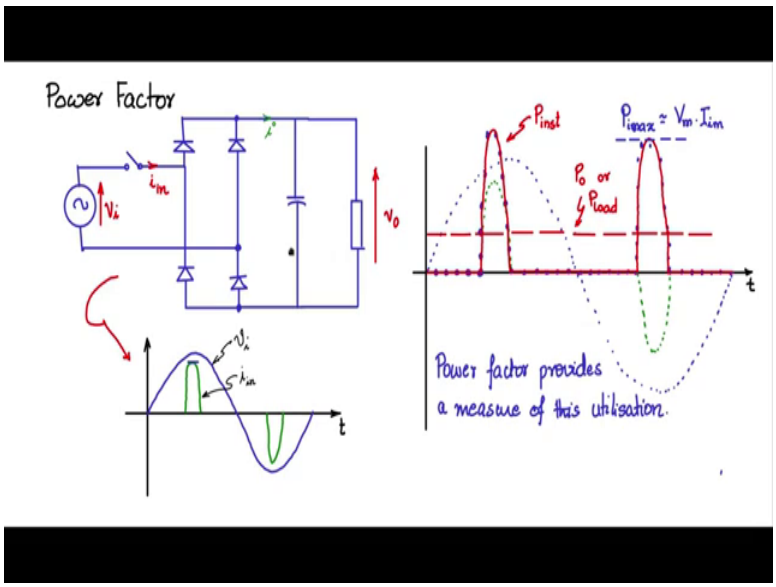

Power factor; what is power factor and why is power factor so important, let us see the motivation for trying to find the power factor and also to improve the power factor of any given load or circuit. So, we have here the regular rectifier capacitor filter circuit that we have been discussing till now, this is input V i source sinusoidal AC, i in is the diode bridge you have the current i here and the v naught here.

Now, look at the input portion power factor is mainly aimed at improving the effect that the grid c or the sources c because that we have put is non-linear rectifier capacitor filter load. So, if we look at the waveforms there this is the x-axis kind t and you put in the voltage sinusoidal voltage curve and the current i in that you would see here when the circuit is active. So, this is V i and this this is i in.

Now, let us try to see how the power curve looks like. So, let us draw bigger version of that and let us put in the voltage wave shape, I am putting it dotted indicating sampling and then let us put in the current wave shape for one cycle. Now, let us calculate the

instantaneous power. Instantaneous power is found by multiplying instantaneous value of current with the instantaneous value of voltage at that time instant.

So, let us say here power is 0 which what it basically means is that the current from here to here is 0. So, the current into whatever the voltage will always be 0, so the power value dots that I am putting here is the instantaneous power which is 0. From here one current condensed current increases, so there is a finite value of current into the voltage so that keeps coming up there. So, you have the power values and then again it become 0 here all up to this point when current begins to flow both current and voltage are negative here, power v into i will be positive. So, it is of this shape and 0 again. And if I can I call the dots this will be the power curve.

Now, this power curve is actually occurring at a very narrow period in time and the at other times it is 0 and to the load it supplies an average value. So, let us say this is the instantaneous power curve, and the average of that is the average value deliver to the load here v naught, i naught and that will be naught or P load. Now, if you take the peak value of this this is let say P i max which is v i max or v max here into i max, i i max here. Now, that will be the peak power that is drawn from the source. Now, imagine let us say for an example the average value of the load here is 100, this is 100 and this P i max here is 1000.

So, for delivering 100 watts of power to the load here you will have to draw 1000 watts at some instant in time from the input mains. What it means is that the input supply and all the upstream, equipments, cables, connectors, switches, plug, sockets all will have to be rated for the high power rating that you would be drawing, only for a short period of time so as to supply the low average load. So, which means that you are under utilising the supply side equipments on the supply. The power factor provides a measure of this utilisation.