Fundamentals of Power Electronics
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Lecture - 27
Power factor – sinusoidal

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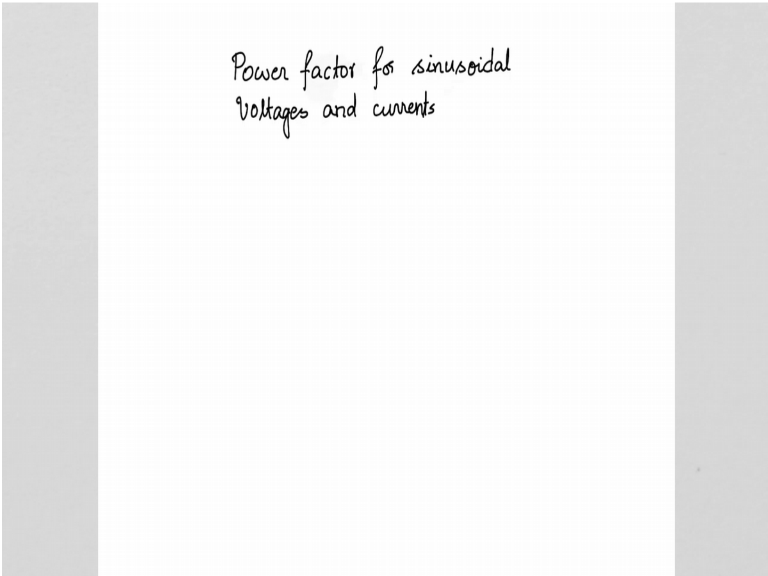

Let us now try to find out the power factor for sinusoidal voltages and currents. The power factor of sinusoidal voltages and currents are already defined, well defined in the literature. Let us apply this measure definition and see if we get the same value and then we shall apply it to the wave shapes of the rectifier capacitor filter voltage and currents.

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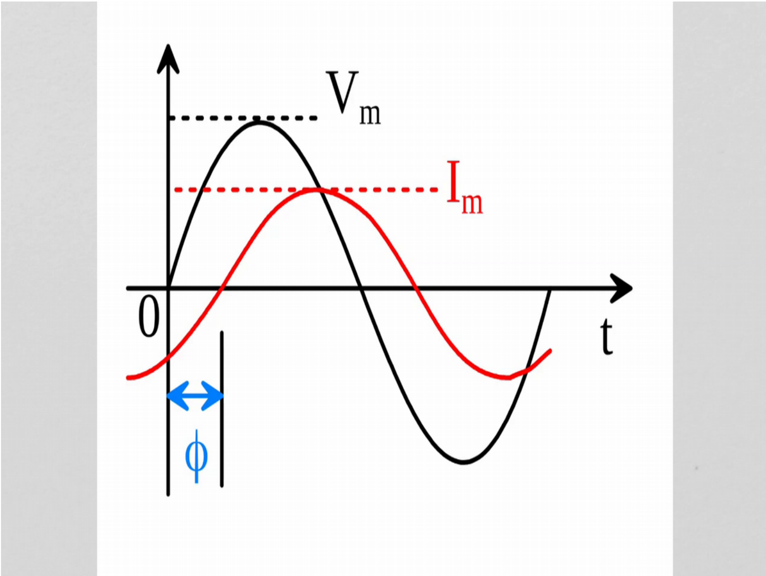

Consider an oscillogram x axis is time and let us place a voltage waveform on this is a voltage waveform and it has a peak amplitude of V m and superimpose a current waveform with an arbitrary delay meaning an R-L load and that delay is phi. And let the current have a maximum value of I m. So, the voltage wave shape in have the equation V m sin omega t, the current wave shape will be having I m sin omega t minus phi.

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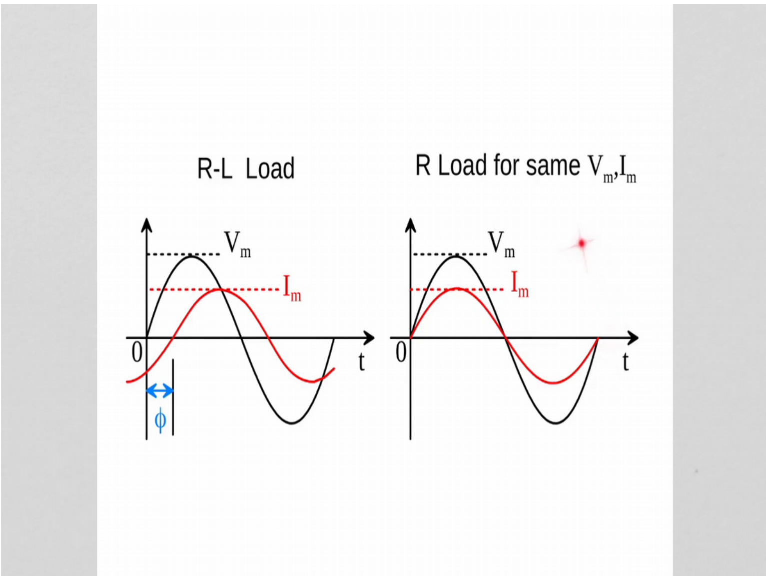

So, if you measure, now let us say this is the unknown load and you have measured something like this on the oscilloscope. How do you compare it with the pure resistive load? So, let us say we would like to bench mark it with respect to pure resistive load for the same magnitude of V m I m. So, let us draw the voltage having the same magnitude V m, then draw the current in the case of a pure -L load the current has to be in phase with the voltage, now retain the same magnitude as I m. And you have this picture that you would have got if it had been pure resistive load.

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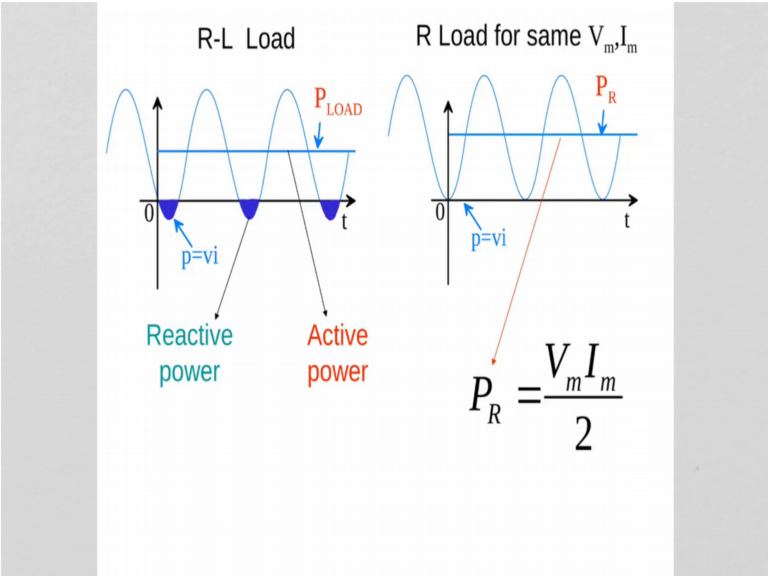

Now, let us find out the powers the instantaneous power curve we know is like this. There is some negative portion here for the R-L load and for the R load there are no negative, there is no negative portions. This is the average P R, this is the average P load for the unknown R-L load.

Let us move it up. Observe this negative portion this is the reactive portion and P load what goes to the load is the active portion. Now, this is the reference resistive load. Now, this value is given as V m I m by 2 this for a pure resistive load. Now, what is this P load? We have the reactive power component; P load is the active power component.

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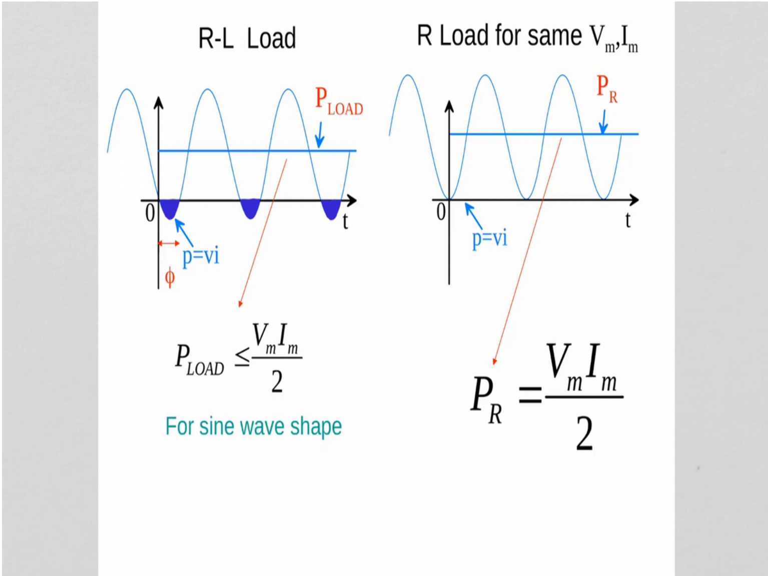

And P load is less than P R, it is less than V m I m by 2 because of this negative part.

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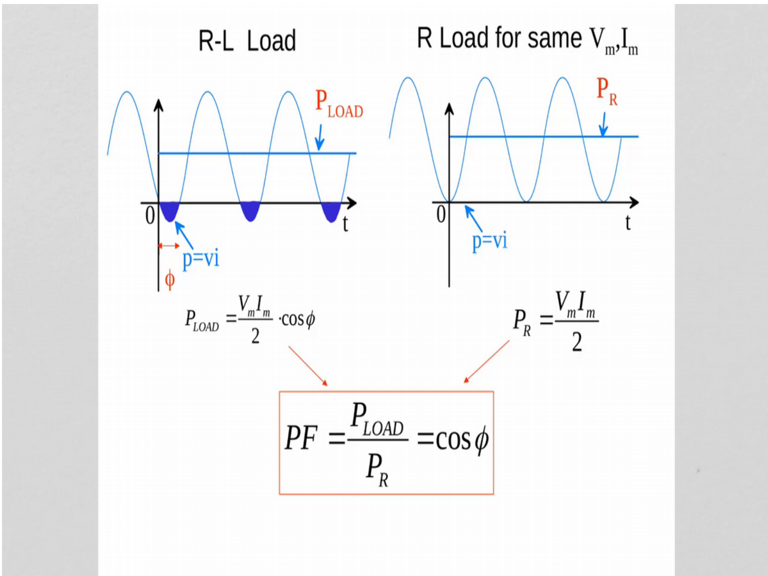

And if it is a sinusoidal case we know that for sine waves P load is V m I m by 2 cos phi where this is phi. So, we now apply our definition of PF is P load by P R any wave shape and for this special case of a sine wave you will get cos phi. So, it verifies that the definition that we have made as a measure of closeness to a pure resistive load any load, any unknown load, measure the closes to a resistive load will provide you the power factor value.