Fundamentals of Power Electronics
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Lecture – 31
Linear regulators - intro

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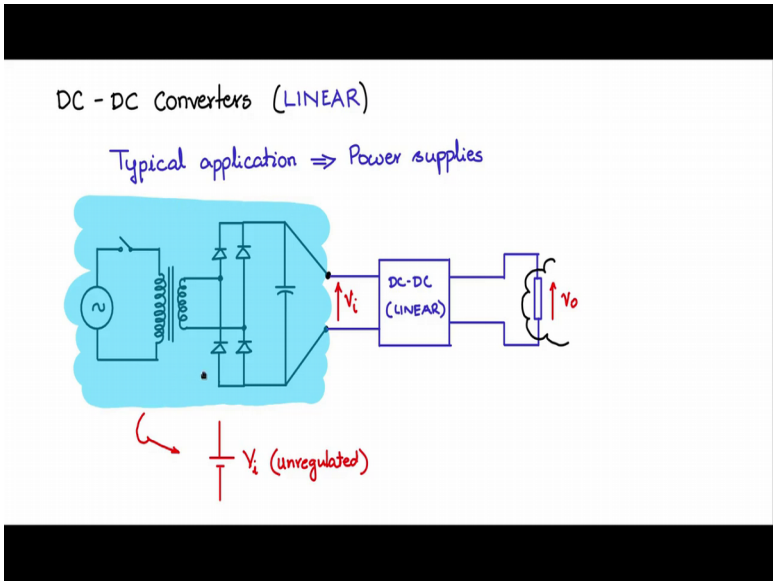

We shall now discuss DC-DC converters. We have seen how to get DC from AC using rectifier capacitor filter, so that DC is unregulated. So, we need to pass it through a DC-DC converter to get a regulated DC output at the output of the DC-DC converter. There are 2 methods broadly in which we can achieve this; one method is by linear circuits, the other method is by using switched mode circuits. We shall discuss the switched mode circuits later. Today we will take up DC-DC conversion using linear circuits, also known as the linear regulators.

When you compare the functional performance of the linear regulator switched mode regulators, the linear regulators are very very superior in terms of line regulation, in terms of load regulation, in terms of temperature regulation and all aspects of functional performance. The only issue which is a disadvantage in the linear regulator is efficiency, it is very lossy. It cannot match the switched mode power converters with respect to efficiency as a consequence the linear regulators are bulkier and costlier.

However, linear regulators play a very important role in power electronics and in power components and in equipments especially in applications like power supplies where in precision output specks are needed to be provided to many of the critical and sensitive loads. So, today we will discuss about the linear regulators.

The typical application for the linear regulators is power supplies. So, most of the power supplies for equipments laboratory power supplies they are based on the linear regulators especially if your requirement is for a very highly stringent output spec. We have seen how to get DC from unregulated DC from AC source. So, if you see we have used a transformer based rectifier diode rectifier capacitor filter like this, we have used this kind of circuit and we have used transformer for inrush current limiting. We discussed this.

They not only does this transformer do inrush current limiting, it also provides galvanic isolation between the AC side and the load side. And further it also provide scaling you can now step down. So, you have 230 volts on this side 325 volts peak and here you may want a 15 volt power supply, the transformer will do the job of scaling. And especially for low power systems low power supplies the choice of using the transformer will be a good one especially from the point of reliability and functional spec.

So, here you have unregulated DC. Now, this is given to a block and that will be the DC-DC regulator block or the linear regulator block and the output of that now here you have regulated DC, that will be given to a load in this fashion. So, all this block is the input to the DC-DC linear regulator and this portion is the output load v naught. Now, all this portion the AC to DC portion we can replace it by this symbol here indicating that that is V i as far as the DC-DC linear regulator is concerned. So, this is the unregulated voltage that you get at this point we can name it as V i and henceforth when we are discussing DC-DC linear regulator. We will not be writing all this instead we will replace it just by this battery symbol at this point.

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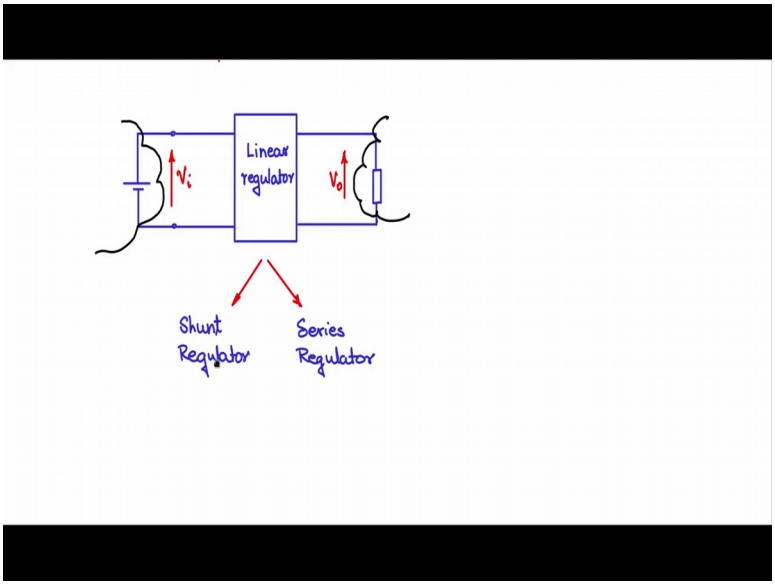

Henceforth, we will be using this symbol to represent either a battery or a unregulated DC obtained from an AC to DC rectifier capacitor filter circuit. Now, this is given to the linear regulator and then further to the load and this will be the regulated the output.

So, this linear regulator the design the operation and the design of that is what we will be looking at . We will call those as V i for the linear regulator and this is the V naught. There are 2 methods in which to achieve the linear regulation; one is called shunt regulator and the other is called the series regulator. Both are in use both are quite popular for different applications. Generally, the shunt regulator is used for references, voltage references much lower power compared to the series regulator which are used for most of the power supplies. We will look at both and we will look at the circuits that govern each of these principles.