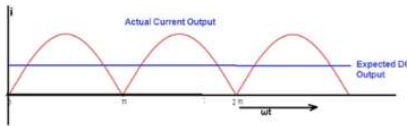


What is Ripple Factor? Ripple factor of Half wave and full wave rectifier

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What is Ripple factor?



Definition - Derivation - Formula

here we are going to take a detailed article related to ripple factor and its significance, We will know in this article about **what is ripple factor?** and **how to calculate the ripple factor.** we will also derive the equation for **half and full wave rectifier** So let see,

Rectifiers are generally used for converting A.c signal into electrical signal. There are different types of rectifier we use for rectification like half wave rectifier, full wave bridge rectifier etc. All the rectifier has different efficiency for applied input A.C signal. Depending on the output we can measure the efficiency and ripple factor of the rectifier.

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What is Ripple Factor?

The output of rectifier consists of D.C component and A.C component also. A.C component in rectified output is called ripple. This A.C component in output is undesirable and accounts for the pulsations in the rectifier output. AC component in rectifier output voltage is called ripple voltage and AC component in output current called ripple current.

Ripple Factor definition: The ratio of r.m.s. value of a.c. component to the d.c. component in the rectifier output is known as the ripple factor.

Ripple Factor = RMS value of AC Component / RMS value of DC component

SO the $R.F = I(ac) / I(dc)$

Ripple Factor is very important in deciding the effectiveness of rectifier output. The smaller ripple factor describes the more effectiveness of that rectifier. The more ripple factor means more fluctuating ac components are present in the rectified output.

This is basically a measurement of ripple which denotes the purity of rectified output. Thus every effort is made to reduce the ripple factor. Here we will not discuss the ways to reduce the ripple factor.

Here we will see why ripple happens in rectifier output?

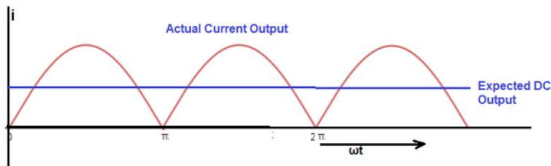
Why Ripple is present?

When the rectification happens by rectifier circuit there is no way to get 100% pure DC output. Some fluctuating AC components are always present in the output of the rectifier. A rectifier circuit is including some diodes or thyristor. Ripple is depended upon the uses of these elements in a rectifier circuit.

Let see with the example of single phase full wave rectifier. Here we use four diodes in a circuit and we get the output as shown in the figure.

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here we expected from the rectifier for the pure DC output waveform but we get some pulsating AC waveform which called ripple in output. By uses of some filter in the circuit, we can able to get nearly DC waveform and can reduce ripple in output.

Ripple factor Formula and Derivation

Ripple factor is given in terms of RMS value of ac component to RMS value of dc component.

$$\begin{aligned} \text{Ripple Factor, } \gamma &= \frac{\sqrt{(I_{rms})^2 - (I_{dc})^2}}{I_{dc}} \\ &= \frac{\sqrt{(V_{rms})^2 - (V_{dc})^2}}{V_{dc}} \end{aligned}$$

So now we derive the formula of ripple factor. Derivation of ripple factor can be easily derived by the definition of ripple factor. As per definition we know, ripple factor is the ratio of rms of ac component to rms of dc components in rectified output.

By I_{rms} and I_{dc} we can find the ripple factor of the rectifier.

$$I_{rms} = \sqrt{I_{dc}^2 + I_{ac}^2}$$

or
$$I_{ac} = \sqrt{I_{rms}^2 - I_{dc}^2}$$

Dividing throughout by I_{dc} , we get,

$$\frac{I_{ac}}{I_{dc}} = \frac{1}{I_{dc}} \sqrt{I_{rms}^2 - I_{dc}^2}$$

But I_{ac}/I_{dc} is the ripple factor.

$$\therefore \text{Ripple factor} = \frac{1}{I_{dc}} \sqrt{I_{rms}^2 - I_{dc}^2} = \sqrt{\left(\frac{I_{rms}}{I_{dc}}\right)^2 - 1}$$

Here now we find ripple factor for half wave and full wave rectifier.

Ripple factor for half wave rectifier

For half wave rectification,

$$I_{rms} = I_m/2$$

$$I_{dc} = I_m/\pi$$

$$\text{Ripple factor} = \sqrt{\left(\frac{I_m/2}{I_m/\pi}\right)^2} - 1 = 1.21$$

Ripple factor of half wave rectifier is about 1.21 by the derivation. As per you can see output voltage has much more AC component in DC output voltage so the half-wave rectifier is ineffective in the conversion of A.C to D.C.

Ripple factor for full wave rectifier

For full wave rectifier,

$$I_{rms} = I_m/\sqrt{2}$$

$$I_{dc} = 2I_m/\pi$$

$$I_{rms} = \frac{I_m}{\sqrt{2}} \quad ; \quad I_{dc} = \frac{2I_m}{\pi}$$

$$\therefore \text{Ripple factor} = \sqrt{\left(\frac{I_m/\sqrt{2}}{2I_m/\pi}\right)^2} - 1 = 0.48$$

$$\text{i.e. } \frac{\text{effective a.c. component}}{\text{d.c. component}} = 0.48$$

This shows that in the output of a full-wave rectifier, the d.c. component is more than the a.c. component. Consequently, the pulsations in the output will be less than in half-wave rectifier. For this reason, full-wave rectification is invariably used for conversion of a.c. into d.c.

Conclusion

Hope you know all about the ripple factor. Here we see the definition and why they present in the output circuit in details. Ripple is the fluctuation in output of the rectifier and

ripple factor is necessary for measuring the fluctuation rate in rectified output. By the uses of some capacitive filter and other filters, we can reduce the ripple in output voltage.

In most of every rectifier circuit uses capacitor in parallel of diodes or thyristor which works as a filter in circuit. This capacitor helps to reduce the ripple in the output of the rectifier. Here we also saw the ripple factor of half wave and full wave rectifier.

Hope you find all you needed here. If you have any question regarding this topic then feel free to ask in the comment section.

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