

Answer on Question#40769 – Physics – Electric Circuits

why is rms values of current and voltage used to calculate power

Solution:

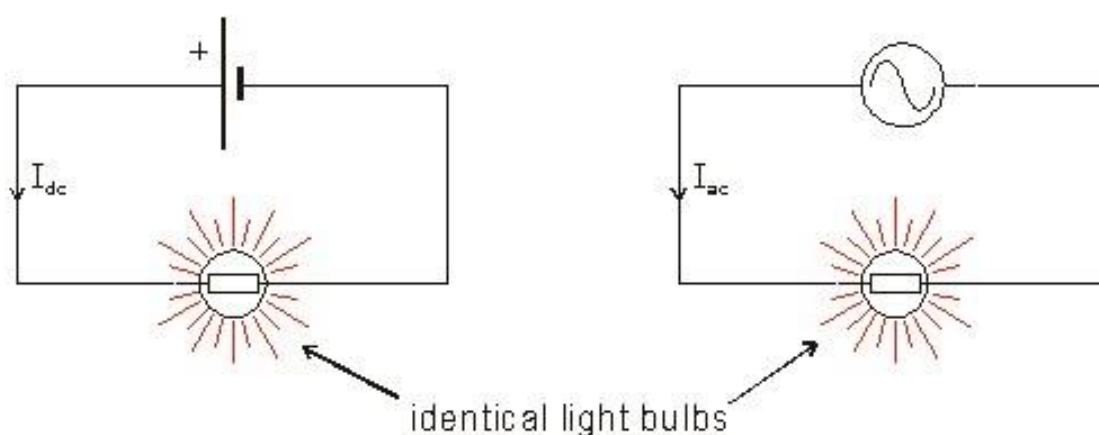
Attempts to find an average value of AC would directly provide the answer zero. Hence, RMS values are used. They help to find the effective value of AC (voltage or current).

This RMS is a mathematical quantity (used in many math fields) used to compare both alternating and direct currents (or voltage). In other words (as an example), the RMS value of AC (current) is the direct current which when passed through a resistor for a given period of time would produce the same heat as that produced by alternating current when passed through the same resistor for the same time.

Practically, we use the RMS value for all kinds of AC appliances. The same is applicable to alternating voltage also. We're taking the RMS because AC is a variable quantity (consecutive positives and negatives). Hence, we require a mean value of their squares thereby taking the square root of sum of their squares.

Peak value is I_0^2 is the square of sum of different values. Hence, taking an average value (mean) $\frac{I_0^2}{2}$ and then determining the square root $\frac{I_0}{\sqrt{2}}$ would give the RMS.

Example:



Consider that both the bulbs are giving out equal-level of brightness. So, They're losing the same amount of heat (regardless the fact of AC or DC). In order to relate both, we have nothing to use better than the RMS value. The direct voltage for the bulb is 115 V while the alternating voltage is 170 V. Both give the same power output. Hence, $v_{rms} = v_{dc} = \frac{v_{ac}}{\sqrt{2}} = 120V$.

