Electric current that periodically reverses direction (alternating current) is used mainly for power distribution (it also
occurs in a variety of other applications, such as telecommunication and many consumer appliances), and it
may be distinguished from direct current (DC), which flows in one direction only.

Alternating current has the advantage of being able to be transformed easily, both up and down, by using
transformers. This means that the power can be stepped up to high voltages, where it is more efficient
to transmit, and then stepped down to low voltages at the point of use. This has the advantage that the
transmission costs are reduced, since the energy is transmitted over longer distances, which is particularly
important in power systems.

The disadvantage of AC systems is that the power consumed by an electrical device can differ from the power
supplied to it. This difference is known as power oscillation, and it can be significant. Power oscillation is
caused by the interaction of the electrical circuit and the electrical devices, and it can be reduced by using
transformers and other devices.

The RMS (root mean square) voltage is the square root of the average over a cycle of the square of the
instantaneous voltage. For a sinusoidal voltage, the RMS voltage is equal to the peak voltage divided by
the square root of 2. The RMS voltage is often used in engineering calculations, since it is a measure of the
average power delivered by the AC voltage.

The peak voltage (V_{peak}) of a sinusoidal voltage is defined as the maximum value of the voltage, and the
RMS voltage (V_{rms}) is defined as the square root of the average power delivered by the voltage. For a
sinusoidal voltage, the RMS voltage is equal to the peak voltage divided by the square root of 2. The RMS
voltage is often used in engineering calculations, since it is a measure of the average power delivered by
the AC voltage.

The RMS voltage is calculated as:

\[ V_{rms} = \sqrt{\frac{1}{T} \int_0^T [v(t)]^2 dt} \]

For a sinusoidal voltage, the RMS voltage is equal to the peak voltage divided by the square root of 2.

The peak-to-peak voltage (V_{pp}) of a sinusoidal voltage is defined as the difference between the peak
values of the positive and negative half-cycles of the voltage. The RMS voltage is equal to the peak-to-
peak voltage divided by the square root of 2.

The RMS voltage is often used in engineering calculations, since it is a measure of the average power
delivered by the AC voltage. The RMS voltage is also used in power distribution systems, since it is a
measure of the power delivered by the voltage.

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