Topic 24 Alternating currents

Summary

- Alternating current or voltage is represented by an equation of the form $x = x_0 \sin \omega t$.
- Peak and root-mean-square (r.m.s.) values of sinusoidal current or voltage are related by an equation of the form $x_0 = \sqrt{2} x_{rms}$.
- For a sinusoidal input, mean power in a resistive load is one half of the peak power.
- For an ideal transformer, $\frac{N_s}{N_p} = \frac{V_s}{V_p} = \frac{I_p}{I_s}$.
- Electrical power is transmitted at high voltages to reduce thermal energy losses in cables.
- A single diode gives half-wave rectification: negative half-cycles are blocked.
- A bridge circuit of four diodes can give full-wave rectification.
- A capacitor across the output reduces the fluctuations of the rectified output voltage.

Definitions and formulae

- $x = x_o \sin \omega t$ for alternating current or voltage
- Time period T is the time taken for one complete cycle of the a.c. $T = 2\pi/\omega$
- The frequency f is the number of cycles per unit time and is $1/T$
- Peak value I_0 or V_0 is the amplitude (maximum value) of the alternating current or voltage
- An r.m.s. a.c. voltage or current is that same value of direct voltage or current that produces the same heating effect in a resistor.
- $P_{max} = \frac{1}{2} I_0^2 R = \frac{1}{2} V_0^2 / R$
- $I_{rms} = I_0/\sqrt{2}$ $V_{rms} = V_0/\sqrt{2}$
- For an ideal transformer $N_s/N_p = V_s/V_p = I_p/I_s$