Circuit Analysis : EEED 2001 Lecture 6

Power flow

DC power = VI

$p(t) = v(t) \times i(t)$

↑ Instantaneous Power

Instantaneous Power (in watts) is the power absorbed by a circuit element at any instant in time.

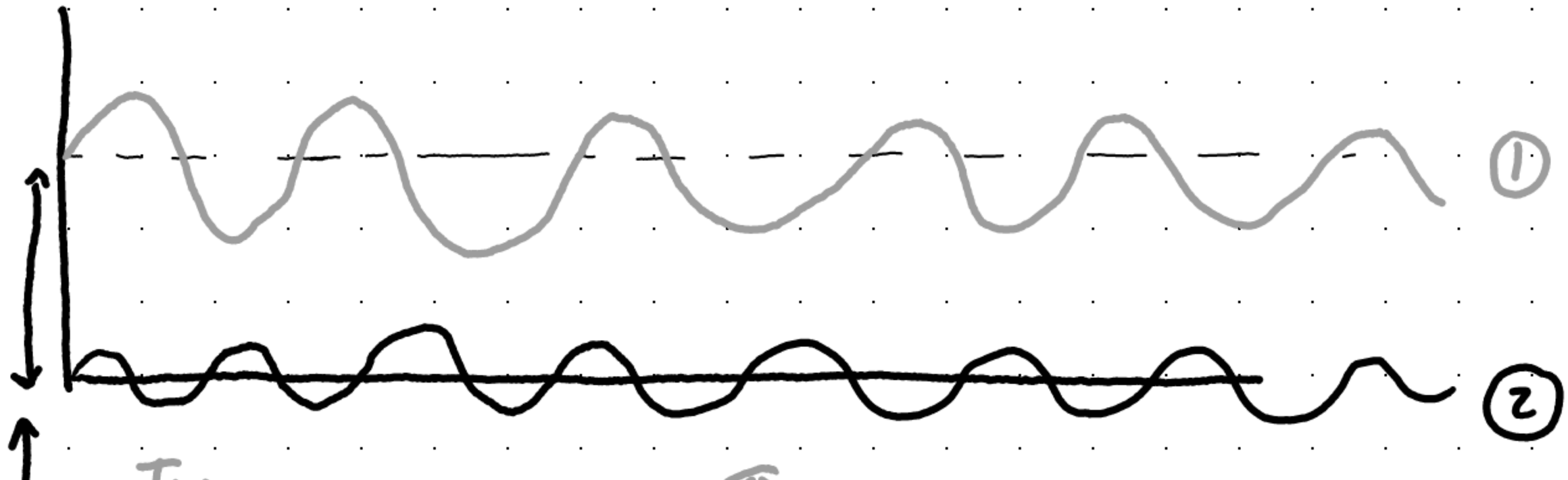
$v(t) = V_{max} \cos(\omega t + \theta_v)$

$i(t) = I_{max} \cos(\omega t + \theta_i)$

So

$$p(t) = \frac{1}{2} V_m I_m \cos(\theta_v - \theta_i) + \frac{1}{2} V_m I_m \cos(2\omega t + \theta_v + \theta_i)$$

- Positive values of power indicate that power is being absorbed by the circuit.
- Negative values of power indicate that power is being generated by the circuit.



The average of ① is the DC offset

The average of ② is 0

The most common power measurement is that of

Average power

$$P_{rms} = V_{rms} i_{rms}$$

$$\text{Average power} = \frac{1}{2} V_m I_m \cos(\theta_v - \theta_i) = \frac{1}{2} \text{Re}(V I^*)$$

First sign

Case 1: purely resistive load (voltage and current are in phase)

$$P = \frac{1}{2} V_m I_m = \frac{1}{2} I^2 R$$

Case 2: Inductive or Capacitive load

$$P = \frac{1}{2} V_m I_m \cos(90) = 0$$