

Power flow

$$DC \text{ power} = VI$$

$$P(t) = V(t) \times i(t)$$

↑
Instantaneous Power

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

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

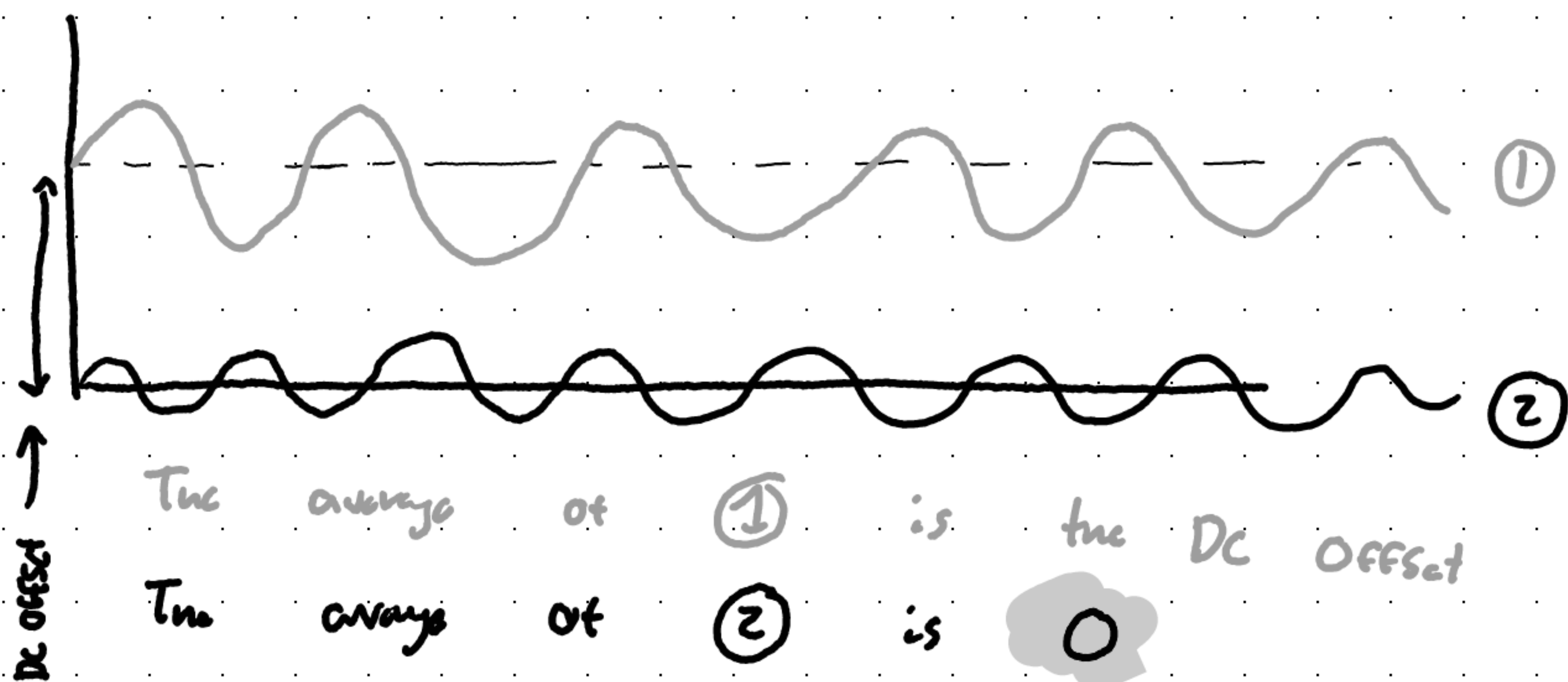
$$i(t) = I_{max} \cos(\omega t + \theta_i)$$

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 indicates times when power is being absorbed by the circuit.

• Negative values of power indicates times when power is being generated by the circuit.



The most common power measurement is that of
Average power

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

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

Flt
Syn

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

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