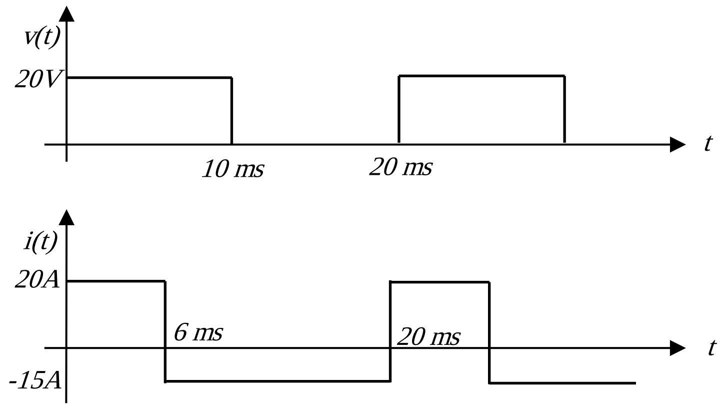
Power Electronics – Walid Issa

Tutorial 1

Problem 1:

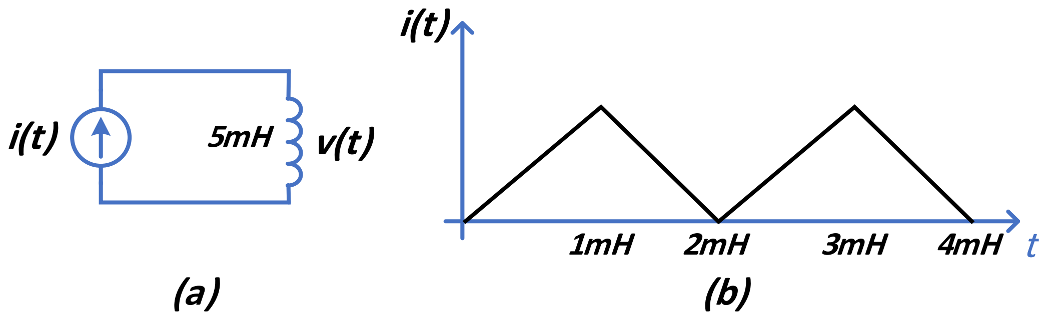
Voltage and current for a device are shown in figures below.

a. Determine the instantaneous power absorbed by the device
b. Determine the energy absorbed by the device in one period
c. Determine the average power absorbed by the device



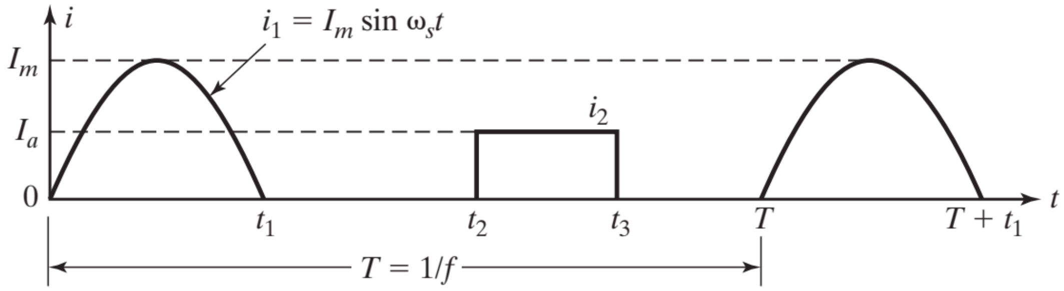
Problem 2:

The current in a 5 mH inductor in Figure (a) is the periodic triangular wave shown in Fig (b). Determine the voltage, instantaneous power and average power for the inductor.



Problem 3:

The current through a diode is shown in the Figure below. Determine (a) the average current and (b) the rms diode current if $t_1 = 100$ µs, $t_2 = 350$ µs, $t_3 = 500$ µs, $f = 250$ Hz, $f_s = 5$ kHz, $I_m = 450$ A, and $I_a = 150$ A.

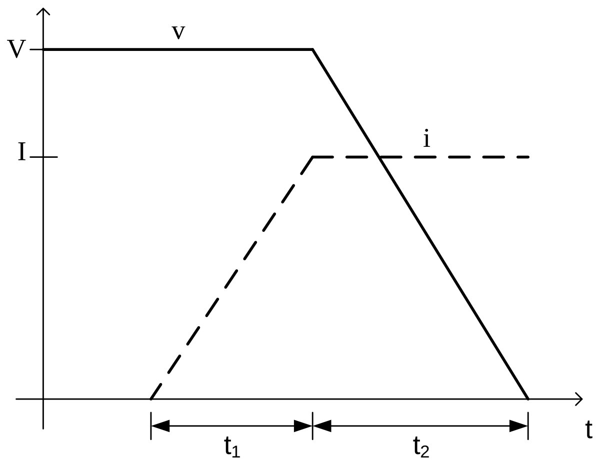


Problem 4:

A 1kW heater load in a food processing system is supplied by an 86% efficiency converter which costs a £100. A higher efficiency (96.8%) converter is offered by you to the system technical team with a cost of £200. The team claims that 10% more efficiency needs 10 years to be paid back …. If the energy cost is £0.1/kWh, discuss the correctness of their claim with cost feasibility of your offer.

Problem 5:

The figure below shows the voltage across a power semiconductor device and current through the device during a switching transition (turn on transition or turn off transition). What is the energy lost during the transition?



(a) Turn on, $\frac{VI}{2}(t_1 + t_2)$
(b) Turn off, $VI(t_1 + t_2)$
(c) Turn on, $VI(t_1 + t_2)$
(d) Turn off, $\frac{VI}{2}(t_1 + t_2)$