Jijel University
Faculty of Science and Technology
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Tutorial 3(TD3)

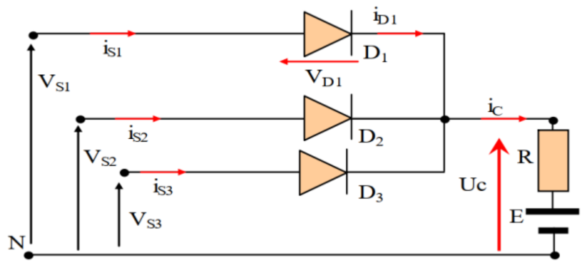
Example 1

The three-phase network 220/380, 50Hz is used to supply, through a single-phase rectifier, a load with an electromotive force (EMF) of E=100V and a resistance of R=50Ω.

$$v_1 = v_m sin(wt)\,,$$

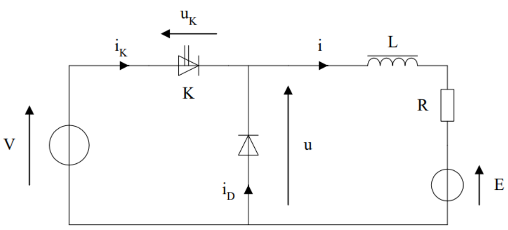
$$v_2 = v_m sin\left(wt - \frac{2\pi}{3}\right),$$

$$v_3 = v_m sin\left(wt - \frac{4\pi}{3}\right)$$



Draw the curves Uc, V_{D2}, and i_c.
Calculate the average value of the rectified voltage and the average current in the load.
Provide the expression, calculate the average value, and plot the current $i_{s2}(t)$.
Calculate the power that the network must deliver.

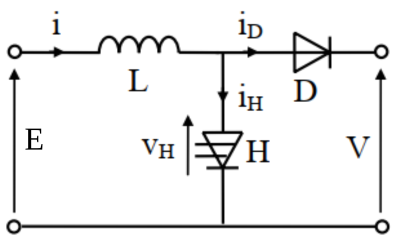
Example 2



A DC motor operating at a constant torque is included in the circuit below
Represent the waveforms of u and u_K as functions of time.
Express the average value of u in terms of V and α.
Illustrate the waveforms of i_K and i_D as functions of time.
Express the average values of currents i_K and i_D in terms of I and α.
Determine the current intensity I in the motor as a function of V, E, R, and α.
Numerical application:
Calculate <u>, I, and <i_D> for V = 220 V, E = 145 V, and α = 0.7.

Example 3

We consider the parallel chopper circuit shown below, where T is the period, and α is the duty cycle.



1.0≤t≤αT: When the switch H is conducting. Write the differential equation governing the evolution of i. Assuming $i(0)=I_0$,
solve the equation to determine i(t). Provide the expression for $I_1=i(\alpha T)$.

2.αT≤t≤T: When the diode D is conducting. Keeping 0 as the time origin, determine the expression for i(t), particularly in terms of I_0

3.Assuming continuous current operation (i does not become zero over the interval$[\alpha T,T]$).

a) By stating that $i(T)=I_0$, derive the relationship between E, V, and α.

b) Sketch the shape of $i(t)$. Deduce its average value I_C in terms of I_0 and I_1.

c) Let $\Delta i=I_1-I0$. Express Δi in terms of E, L, α, and T.

d) Deduce from the two previous relations the expressions of I_0 and I_1 in terms of I_C and Δi.

e) Application: E=200V, α=0.25, L=5mH, I_C=10A, T=1ms. Calculate I_0, I_1, and V, then plot the waveforms of i, i_H, i_D, and v_H.