Exercise 1

The output voltage $U_o = 5$V is kept constant by adjusting the switch duty ratio D when the input voltage U_d is varying between 10V and 40V. The output power is $P_o \geq 5$W, and the switching frequency is $f_s = 50$kHz. Calculate the value of the inductance L that keeps the circuit working in the continuous conduction mode (CCM). The current of the choke, i_L, is considered greater than zero.
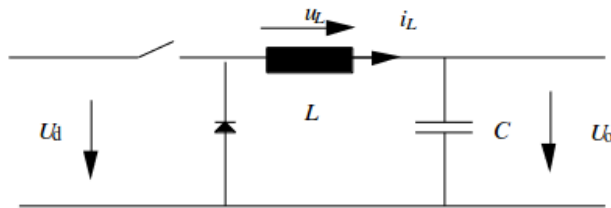

Figure 1: Buck converter.

Exercise 2

In the previous exercise, the capacitance C was considered large enough so that the output $u_o(t)$ was considered as constant. Calculate the peak-to-peak voltage ripple ΔU_o when the capacitance $C = 470\mu$F.

Exercise 3

Continuing the same exercise, calculate the peak-to-peak voltage ripple ΔU_o when the output power P_o decreases by 50%. Therefore, the average of the output current is now $I_o = 0,5$A and the converter is working in a discontinuous conduction mode (DCM).