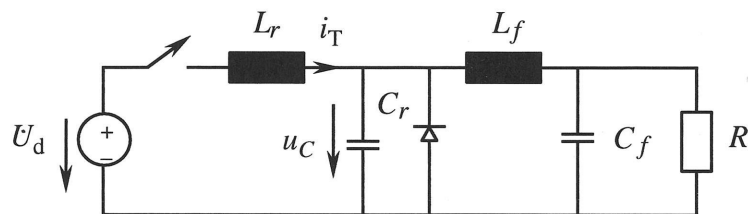


Note! Remember to fill in the course feedback, gives one bonus point.

1. In a Buck converter output voltage $U_o = 5$ V and supply voltage changes as $10 \text{ V} \leq U_d \leq 15$ V. Output power $P_o \geq 50$ W, switching frequency $f_s = 300$ kHz and output capacitor $C = 47$ μ F. Derive equations and calculate the value of the required filtering inductance so that the operation is always at continuous conduction mode. Calculate ripple component in the output voltage.
2. In the Zero Current Switching converter shown below $f_0 = 1$ MHz, $Z_0 = 10$ Ω , $P_o = 10$ W, $U_d = 15$ V ja $U_o = 10$ V. At the time of closing the switch inductance L_r has no current, C_r no voltage and the constant load current flows through the diode. Sketch the waveform of the current i_T and capacitor voltage u_C and write their equations in time domain. Calculate the important corner time values of these waveforms. Calculate the maximum values of the current and voltage.



Current and voltage of the resonant circuit with initial values I_{L0} and U_{C0} and output current I_o can be calculated from:

$$i_L = I_o + (I_{L0} - I_o) \cos \omega_0 t + \frac{U_d - U_{C0}}{Z_0} \sin \omega_0 t$$

$$u_C = U_d - (U_d - U_{C0}) \cos \omega_0 t + Z_0 (I_{L0} - I_o) \sin \omega_0 t \quad \omega_0 = 2\pi f_0 = \frac{1}{\sqrt{L_r C_r}} \quad Z_0 = \sqrt{\frac{L_r}{C_r}}$$

3. In a Flyback-converter turns ratios $N_1:N_2 = 5:1$, output voltage $U_o = 3$ V, supply voltage $U_d = 48$ V, output power $P_o = 60$ W and switching frequency $f_s = 200$ kHz. The magnetizing inductance of the magnetic core is 0,2 mH and converter operates in continuous area, i.e. the magnetization of the core is always higher than zero. Derive equations for the maximum current and voltage ratings of the switch used in the converter and calculate their numerical values
4. You are designing ac/dc rectifier to be used in a switched-mode power supply. What aspects should be taken into consideration when designing the rectifier?
5. Which factors are having an effect on the efficiency of a switched-mode power supply? How efficiency can be improved?