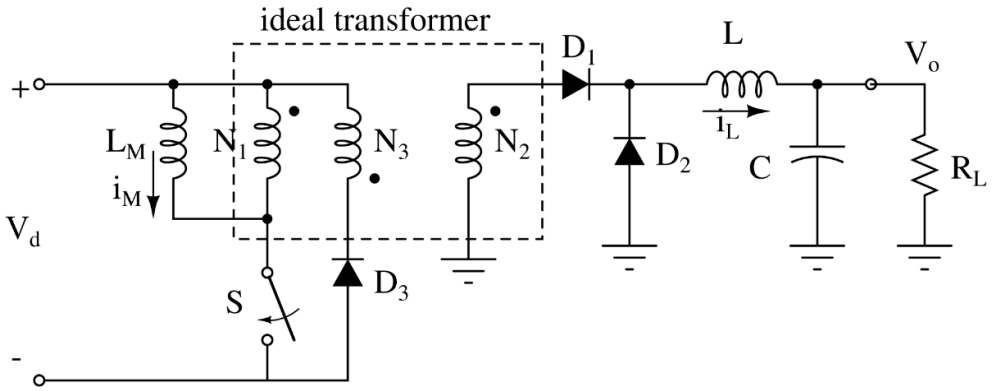
EE419/519 Homework Assignment #4

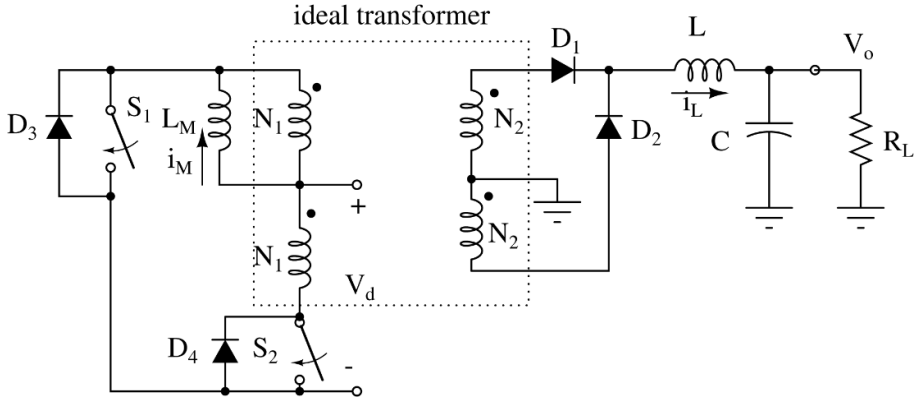
Due December 17, 2024

1. Consider the following converter. S is ON for D_1T_S. The capacitor, C, is sufficiently large so that the output ripple is negligible. Ignore the voltage drop of the diodes. We have V_d=300V, L=100µH, L_M=1.5mH, and T_S=40µs.



   i. Assuming that i_L is always greater than 0, choose N_1, N_2, and D to have V_o=12V.
   ii. Find the maximum value of R_L to ensure a continuous mode of operation.
   iii. Choose a value for N_3 to have i_M go to zero 4µs before the end of the cycle.
   iv. Choose a load resistance R_L larger than the maximum value. Determine the output voltage under this condition. Note that the average value of i_L is equal to V_o/R_L.

2. The converter below has V_d=200V, D, T_S=40µs. S_1 and S_2 are ON consecutively for a duty cycle of D<0.5. S_1 turns on at the beginning of the cycle, and S_2 turns on at the half-point of the cycle. The capacitor, C, is sufficiently large so that the output ripple is negligible. Ignore the voltage drop of the diodes. The inductors are L_M=18mH and L=100µH.



   a. Assume that both diodes D_1 and D_2 are ON during the time switches are off. Choose N_1, N_2, and D to have V_o=18V.
   b. Find the maximum value of R_L to ensure this mode of operation by plotting the i_L for the boundary case. Note that during the time switches are both off, to assure that both D_1 and D_2 are ON, $i_L(t)$ should be greater than $(N_1/2N_2)V_dDT_s/L_M$.
   c. Plot the diode currents i_{D1} and i_{D2} for the boundary case.