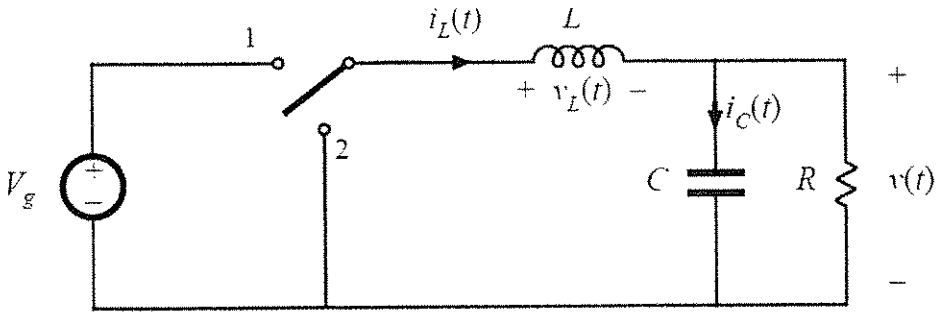
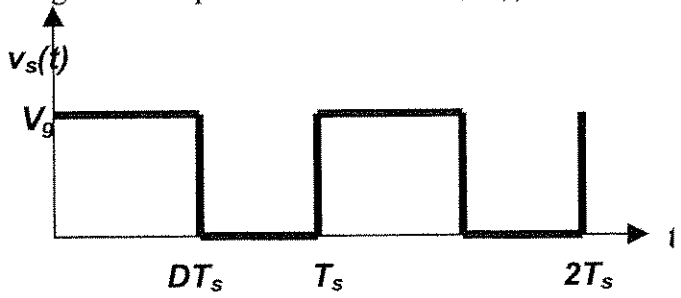
(1) We have the following circuit:



- The switch has a duty cycle of D and a switching frequency of $f_s=1/T_s$, so that the voltage at the input to the inductor L, $v_s(t)$, takes the following waveform:



  Assume that the switching frequency f_s is higher than the bandwidth of the low-pass LC filter. Perform a steady-state DC analysis of the circuit and find out the relationship between the DC component of the output voltage v and input voltage V_g.

  Hint: Consider the principle of capacitor charge balance or the principle of inductor volt-second balance.

- Can you draw the approximate waveforms of the voltage across and the current through inductor L, $v_L(t)$ and $i_L(t)$, during the stead-state?