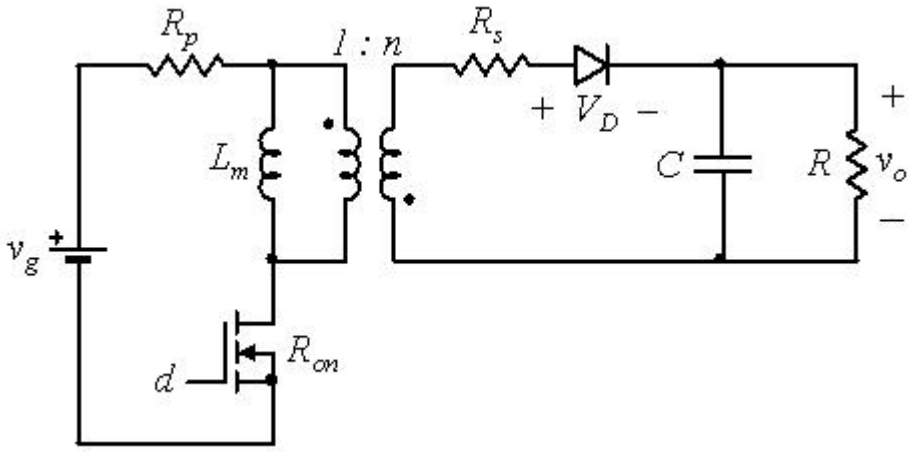
HW #4

PROBLEM 1: (Modified textbook Prob. 7.10)
The flyback converter shown in the figure, operates in CCM.



a. Reduce the converter to an equivalent buck-boost converter by reflecting all the circuit components to the secondary.
b. Using a PWM switch average model, draw a complete average equivalent circuit model of the converter, which is valid in the continuous conduction mode and which accurately models the losses shown in the circuit, as well as the converter input and output ports. To demonstrate this, find the converter DC conversion ratio, $M = V_o / V_g$.
c. Using a PWM switch small-signal model, draw a complete small-signal ac equivalent circuit model of the converter. To demonstrate its validity, find the DC values of the small-signal line-to-output transfer function, $G_{vg}(0) = \hat{v}_o / \hat{v}_g$, and the small-signal control-to-output transfer function, $G_{vd}(0) = \hat{v}_o / \hat{d}$.

PROBLEM 2: (Modified textbook Prob. 7.12)

Use a PWM switch average model to derive an equivalent circuit that models dc and small-signal ac signals in the buck-boost converter. You may assume that the converter operates in the continuous conduction mode, and that all elements are ideal.

a. Show the circuit diagram of the large-signal averaged model for this converter.
b. From the circuit in part (a), find the expressions for the average output voltage, $\bar{v}_o = \langle v_o \rangle_{T_s}$, and average input current, $\bar{i}_g = \langle i_g \rangle_{T_s}$, as functions of the average input voltage, $\bar{v}_g$, average duty cycle, d, and circuit parameters.
c. Perturb and linearize your circuit equations of part (b), to obtain a single equivalent circuit that models dc and small-signal ac signals in the buck-boost converter.

PROBLEM 3: Textbook Prob. 8.16