

Assignment 4

Modeling and Control of Power Electronics Systems ECEN 5807

The n -Extra Element Theorem

- 1 Do problem 10.10 of the textbook.
- 2 The ac model of a boost converter is illustrated in Fig. 1 below.

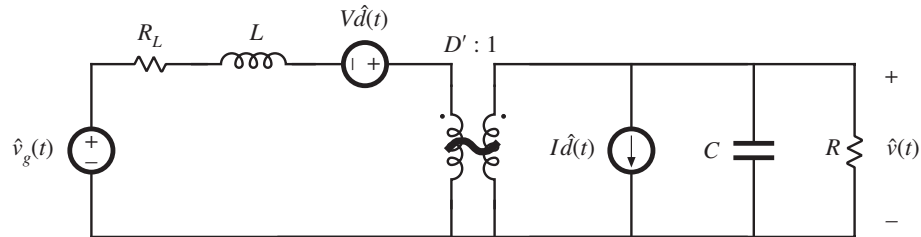


Fig. 1 Large-signal DC and small-signal AC model of the CCM boost converter, including inductor resistance R_L .

- (a) Use the n -Extra Element Theorem to derive an expression for the control-to-output transfer function $G_{vd}(s)$ of this circuit. No credit will be given for other methods.
 - (b) Can the inductor resistance be used to move the right half-plane zero into the left half plane? What is the resulting effect on converter efficiency?
- 3 In previous assignments this semester, we have employed the SEPIC averaged switch model illustrated in Fig. 2 below. Use the n -Extra Element Theorem to derive an expression for the control-to-output transfer function $G_{vd}(s)$ of this circuit. No credit will be given for other approaches.

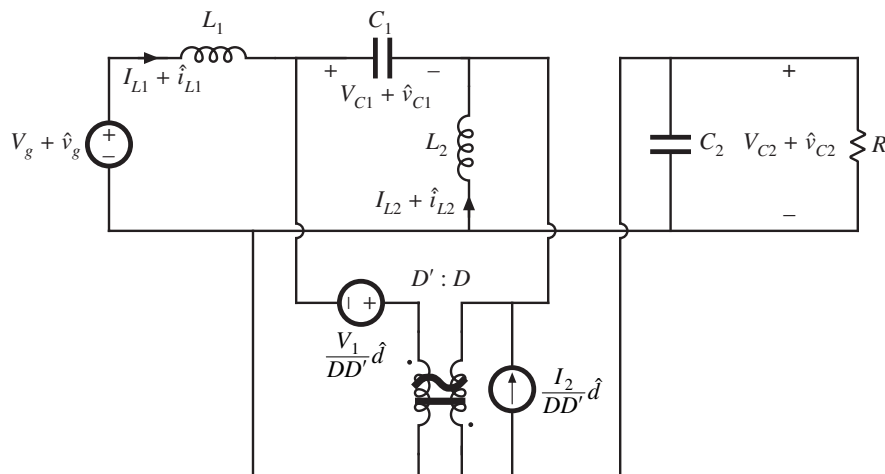


Fig. 2 Averaged switch model of the SEPIC.