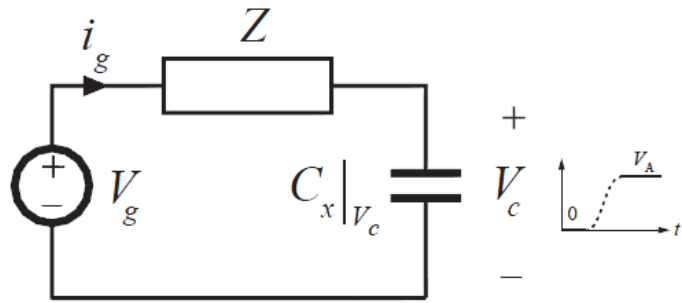


Example Simulation

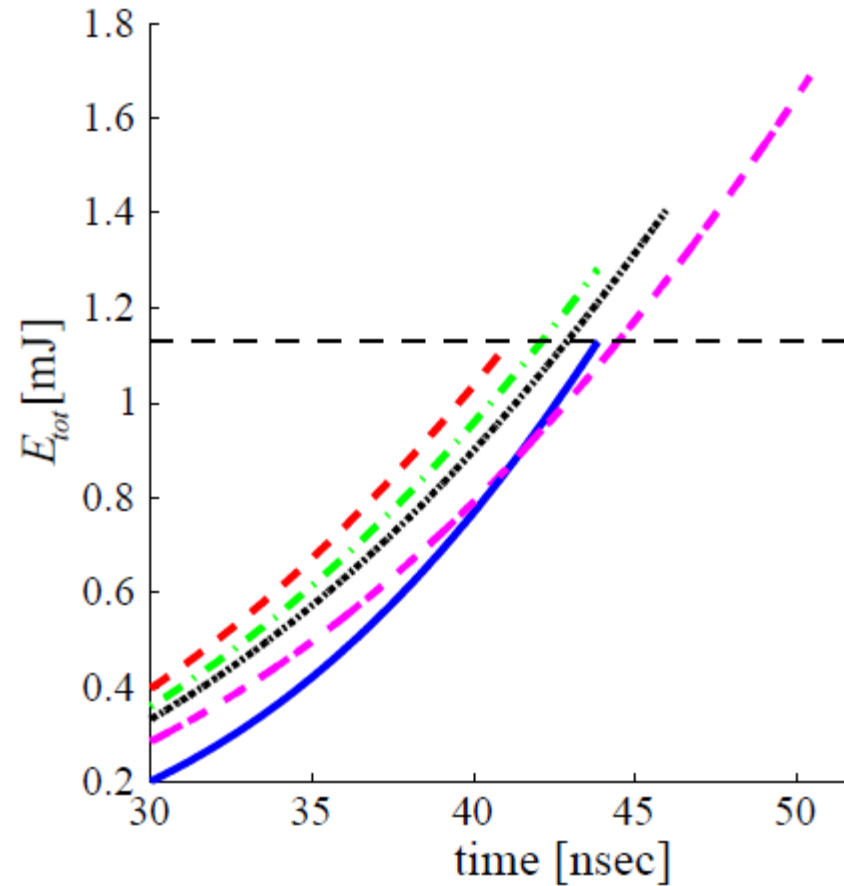


$$C_{eq,Q} = 70.5 \text{ pF},$$

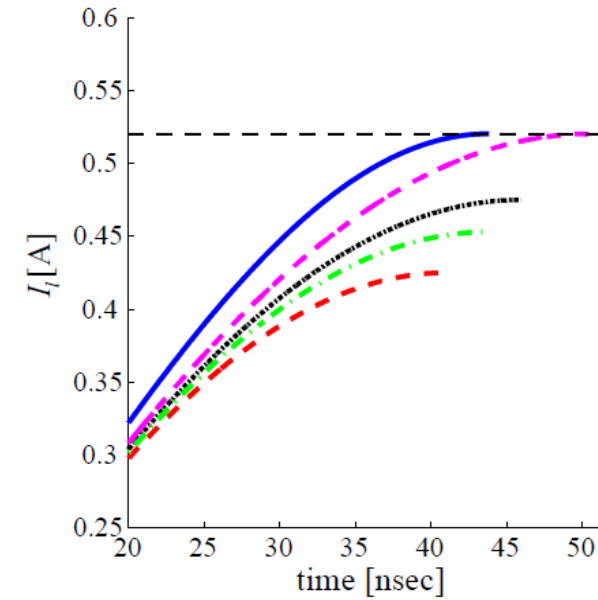
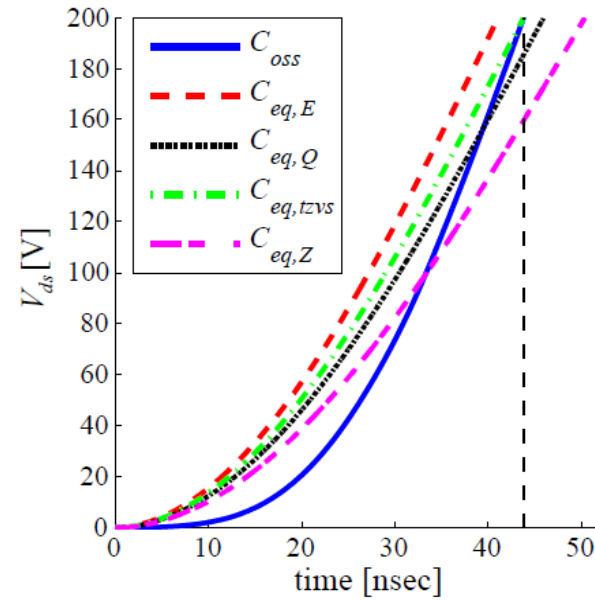
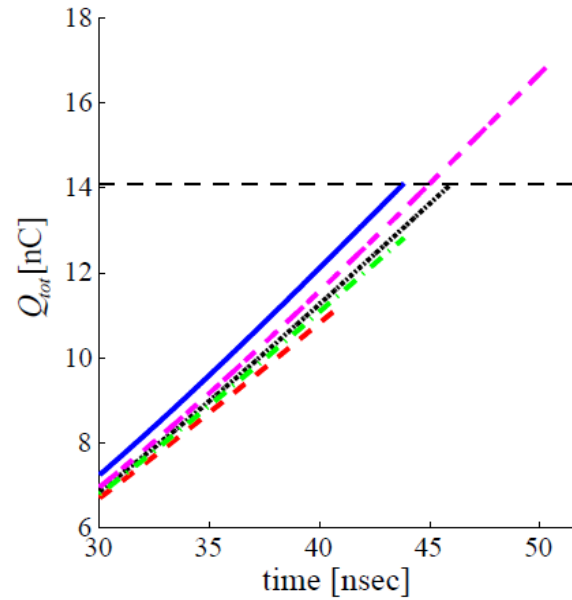
$$C_{eq,E} = 56.4 \text{ pF},$$

$$C_{eq,tzvs} = 64.1 \text{ pF}$$

$$C_{eq,Z} = 84.5 \text{ pF}.$$



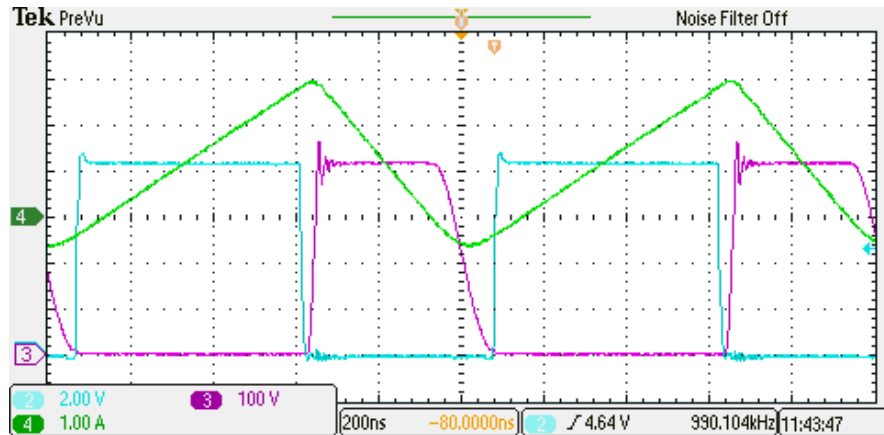
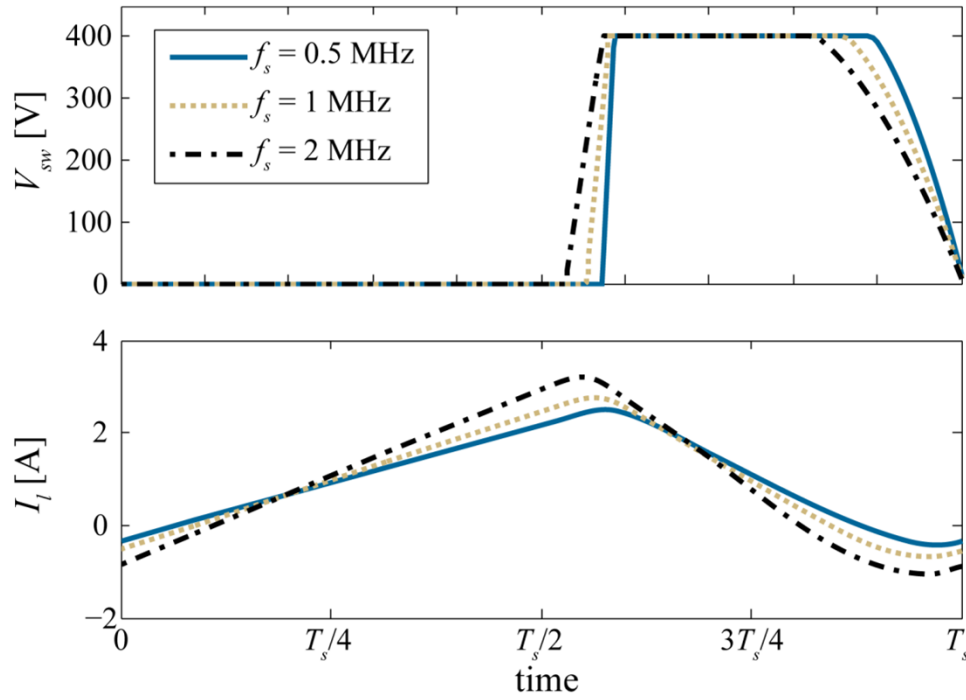
Further Simulation



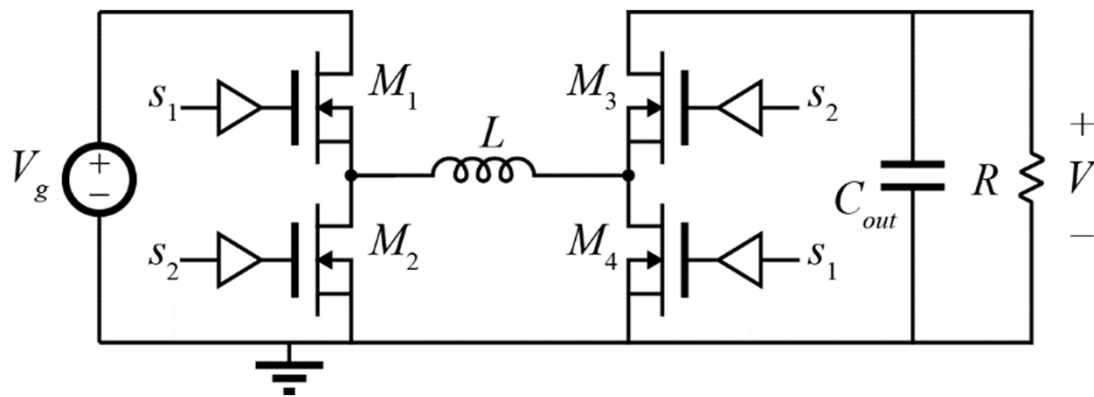
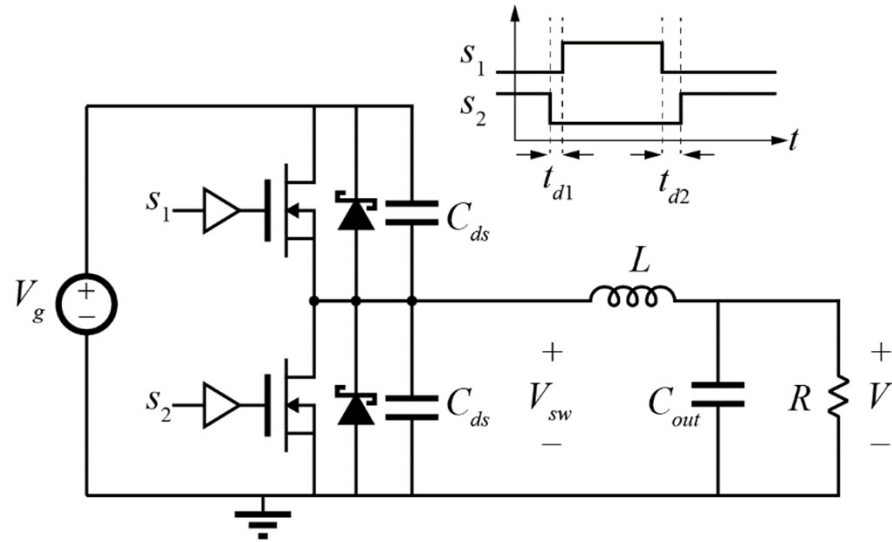
Solving resonance in power electronics

STATE PLANE ANALYSIS

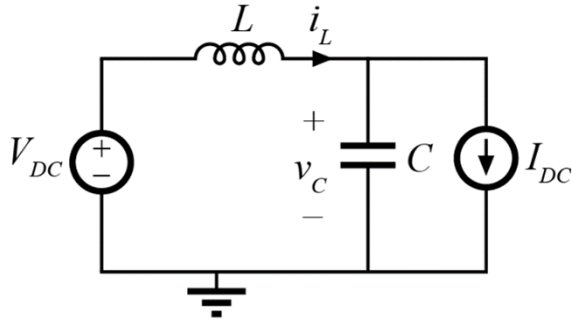
Motivation



Time-Domain Analysis of Switching Transitions



Resonant Circuit Solution



$$v_c(t) = V_{DC} + (V_0 - V_{DC}) \cos\left(\frac{t}{\sqrt{LC}}\right) + (I_0 - I_{DC}) \sqrt{\frac{L}{C}} \sin\left(\frac{t}{\sqrt{LC}}\right)$$

$$i_L(t) = I_{DC} + (I_0 - I_{DC}) \cos\left(\frac{t}{\sqrt{LC}}\right) + (V_{DC} - V_0) \sqrt{\frac{C}{L}} \sin\left(\frac{t}{\sqrt{LC}}\right)$$

Normalization and Notation

$$v_c(t) = V_{DC} + (V_0 - V_{DC}) \cos(\omega_0 t) + R_0(I_0 - I_{DC}) \sin(\omega_0 t)$$

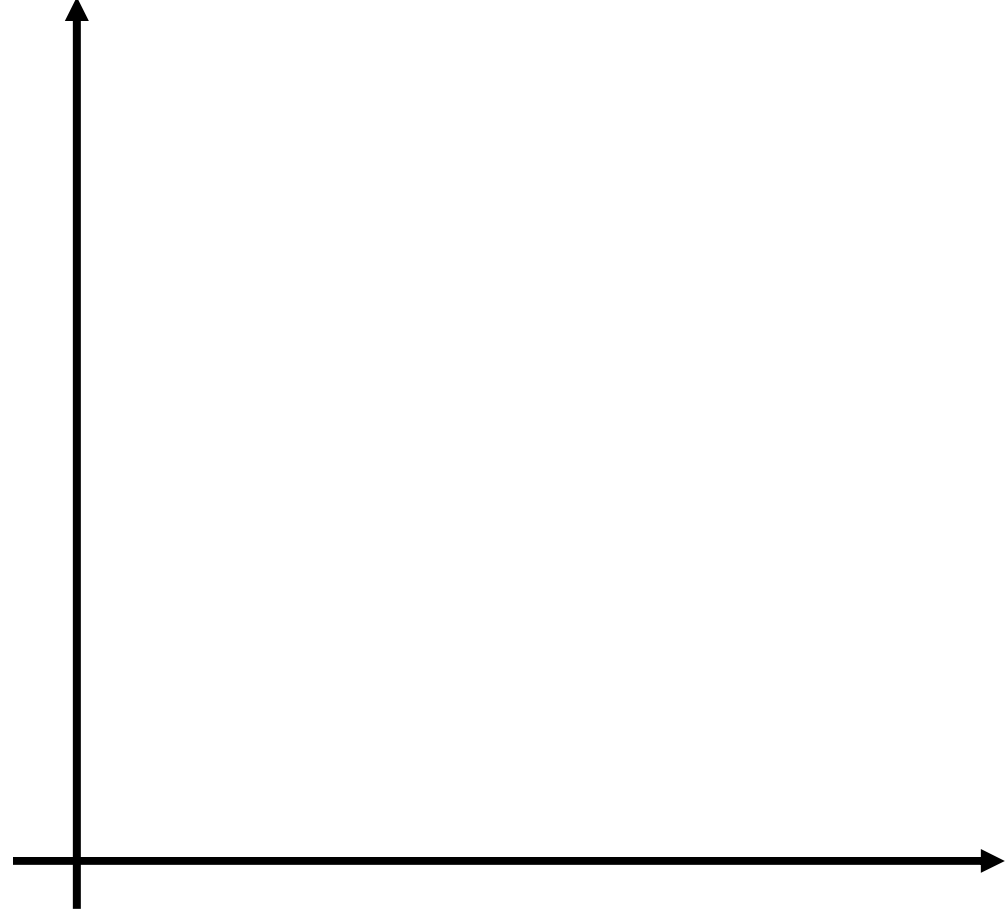
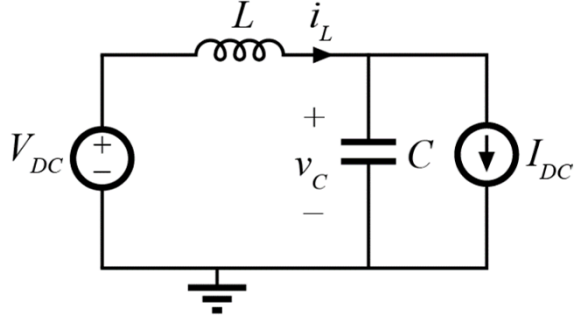
$$i_L(t) = I_{DC} + (I_0 - I_{DC}) \cos(\omega_0 t) + \frac{1}{R_0} (V_{DC} - V_0) \sin(\omega_0 t)$$

$$v_c(t) = V_{DC} + (V_0 - V_{DC}) \cos(\omega_0 t) + R_0(I_0 - I_{DC}) \sin(\omega_0 t)$$

$$i_L(t) = I_{DC} + (I_0 - I_{DC}) \cos(\omega_0 t) + \frac{1}{R_0} (V_{DC} - V_0) \sin(\omega_0 t)$$



State Plane Analysis



- [1] R. Oruganti and F. C. Lee, "Resonant Power Processors, Part I – State Plane Analysis", Industry Applications, IEEE Tran. on, vol. 21, no. 6, nov 1985.
- [2] D. P. Atherton, Nonlinear Control Engineering. London: Van Nostrand Reinhold, 1982, Ch. 2.

Example Analysis

