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ENEE 610
Homework Problems for Grading, Set 1 (60 points)
Due at class M 09/13/04
Setting up equations

1.(30 points)

a) Find the second order differential equation in terms of x_2 for the system of nonlinear differential equations

$$\frac{dx_1}{dt} = -\omega_o x_2 + f(t)$$

$$\frac{dx_2}{dt} = \omega_o x_1 - \varepsilon x_2 \cos(x_2)$$

b) Using PSpice and assuming *f(t)=0* implement these equations using capacitors and voltage controlled current sources. Run curves for different values of ω_o, ε, and initial conditions. For grading submit curves with ω_o=1, ε taking on six different values, $\varepsilon = \pm 0.1, \pm 1, \pm 10$, and initial conditions x1=0.2=-x2 and x1=9.5=-x2. Submit also the PSpice schematic.

c) Insert f(t)=cos(0.2πt) and repeat part b).

2. (30) points

The following represents a boost converter with equal load, Rc, and source, Rs, resistors, normalized to unity resistance. Assuming the circuit has been forever as shown, before t=0, after which the switch changes position (goes up) at t=0, and remains as switched, draw a circuit which is time-invariant and gives the same result as the boost converter for t>0. Set up the state variable equations and derive the solution valid for t>0 in the critically damped case. Are there values of L and C which will allow the output voltage, Vc, to eventually be larger than the input voltage E?