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ENEE 610
Problems to consider, Set 3
State and ODEs in PSpice

1. Read Sections 5.4 & 5.5, p. 216-223.

2. For the lossless driving point impedance

$$z(s) = \frac{2s(s^2+2)}{(s^2+1)(s^2+4)}$$

a) Synthesize this by the 1st Cauer form.

b) From the 1st Cauer circuit set up state variable equations, (5.4-1) and (5.4-3) assuming a voltage source excitation, u, and input current as output y.

c) Repeat for the 1st Foster synthesis.

3. For the z(s)of 2. above taken as the transfer function H(s) in (8.7-9), p. 370,

a) set up state variable equations following Figure 8.7-4, p. 371 and compare with the results of 2.b) above.

b) find a transformation on the state to take this set of state variable equations into those of 2.b) above.

4. For each of the functions listed below used in the following set of (oscillator type state) differential equations set up an ideal circuit in the PSpice schematic editor and run. Check for limit cycles (as per Figure 11.2-4, p. 455) for different initial conditions by plotting x_2 versus x_1. Comment upon the results.

$$\begin{bmatrix} \frac{dx_1}{dt} \\ \frac{dx_2}{dt} \end{bmatrix} = \begin{bmatrix} 0 & -3 \\ 3 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \begin{bmatrix} 0 \\ f(x_1) \end{bmatrix}$$

a) f(x) = 0
b) f(x) = x(x-1)(x+2)
c) f(x) = -x(x-1)(x+2)
d) f(x) = a[tanh(2x)]x^b a and b = parameters, $-2 \le a,b \le 2$.

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