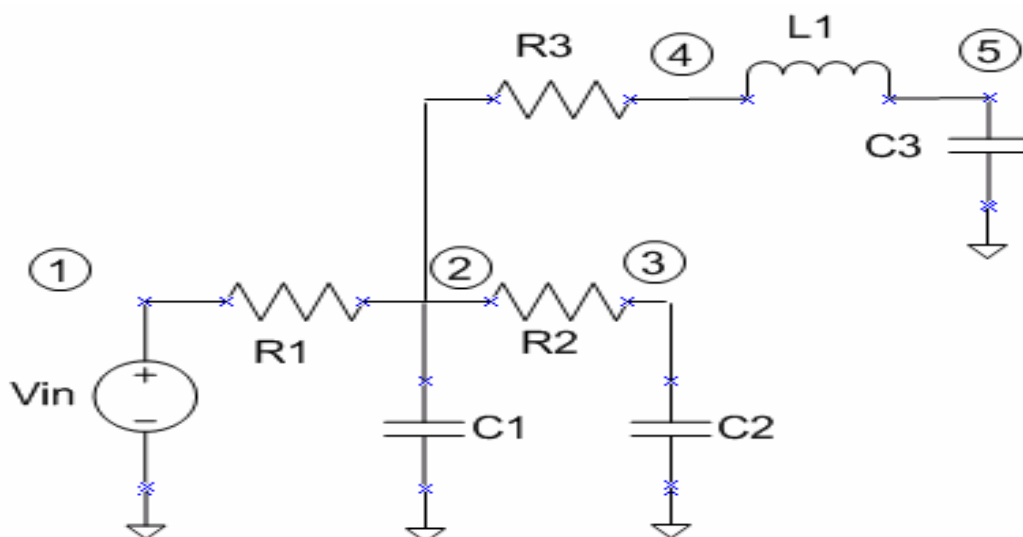


CSE245 Computer Aided Circuit Simulation and Verification

Homework 2. Due 10/26/2004

1. Moment Calculation

For the following circuit, identify state variables and write down the first four moments (m_0, m_1, m_2, m_3) for each of the state variable. Assume that input V_{in} is an impulse function.



2. Pade Approximation

Using the four moments derived above to approximate the transfer function of state variable V_3 (voltage across C_2) in the format of:

$$\hat{H}(s) = \frac{b_0 + b_1 s + \dots + b_{q-1} s^{q-1}}{1 + a_1 s + \dots + a_q s^q} \quad (q=2).$$

Assume that $R_1=2, R_2=R_3=1, C_1=C_2=1, C_3=2$, and $L_1=1$.

3. LU Factorization.

For the following symmetric matrix:

$$M = \begin{bmatrix} x & 0 & & 0 & x & 0 \\ 0 & x & 0 & & 0 & x & 0 \\ & 0 & x & 0 & & & . \\ & & & . & & & . \\ . & & & & . & & \\ & . & & & & . & \\ & 0 & x & 0 & & 0 & x & 0 \\ & & 0 & x & 0 & & 0 & x \end{bmatrix}$$

- a) What's the structure of the L and U matrices obtained from L-U factorization?
- b) How many floating point operations (only count multiplication and division) are necessary for the LU factorization of the above matrix?

4. Sparse Matrix Ordering

Given a matrix A:

$$A = \begin{bmatrix} x & x & x & 0 & 0 & 0 & 0 \\ x & x & 0 & x & x & 0 & 0 \\ x & 0 & x & 0 & 0 & x & x \\ 0 & x & 0 & x & 0 & 0 & 0 \\ 0 & x & 0 & 0 & x & 0 & 0 \\ 0 & 0 & x & 0 & 0 & x & 0 \\ 0 & 0 & x & 0 & 0 & 0 & x \end{bmatrix}$$

- a) Using L-U factorization, what's the total number of non-zero elements in the L and U matrices?
- b) Try to reorder the matrix before L-U factorization to minimize number of fill-ins. Write your reordered matrix and total number of non-zero elements in the L and U matrixes obtained from L-U factorization of the new matrix.