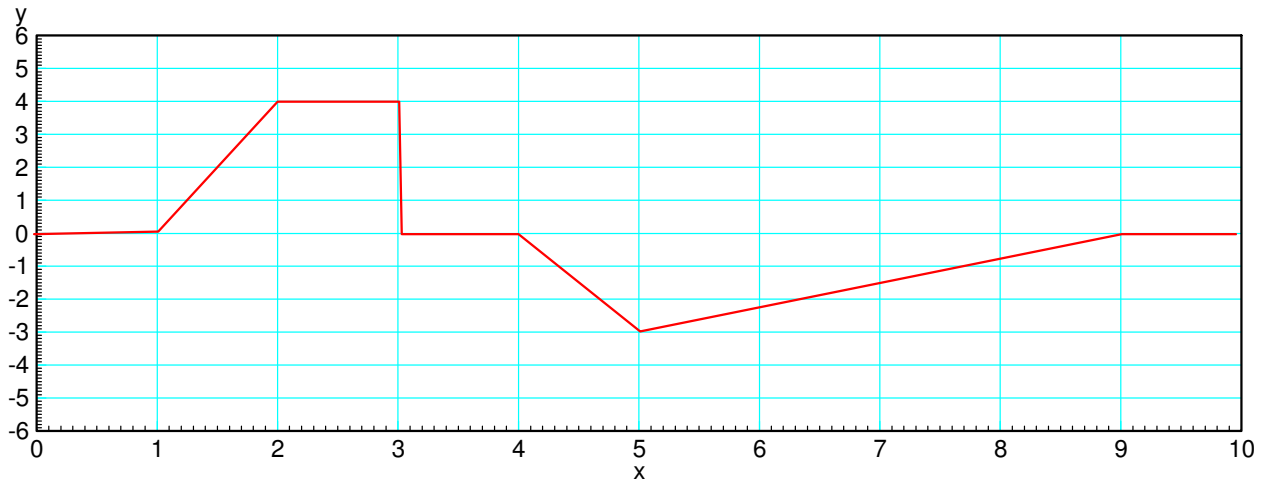


ECE 111 - Homework #7

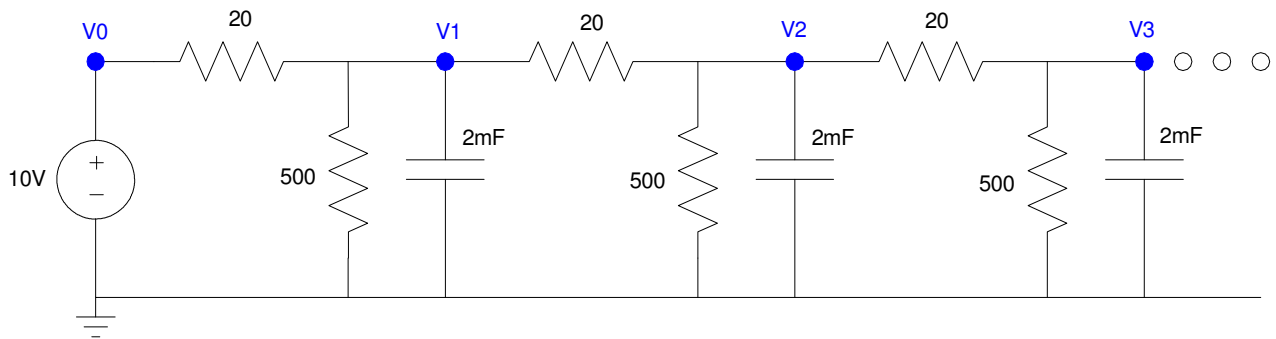
Week #7: ECE 311 Circuits II - - Due 11am Tuesday, October 4th

1) Assume the current flowing through a one Farad capacitor is shown below. Sketch the voltage. Assume $V(0) = 0$. The voltage is the integral of the current (capacitors are integrators)

$$V = \frac{1}{C} \int I \cdot dt$$



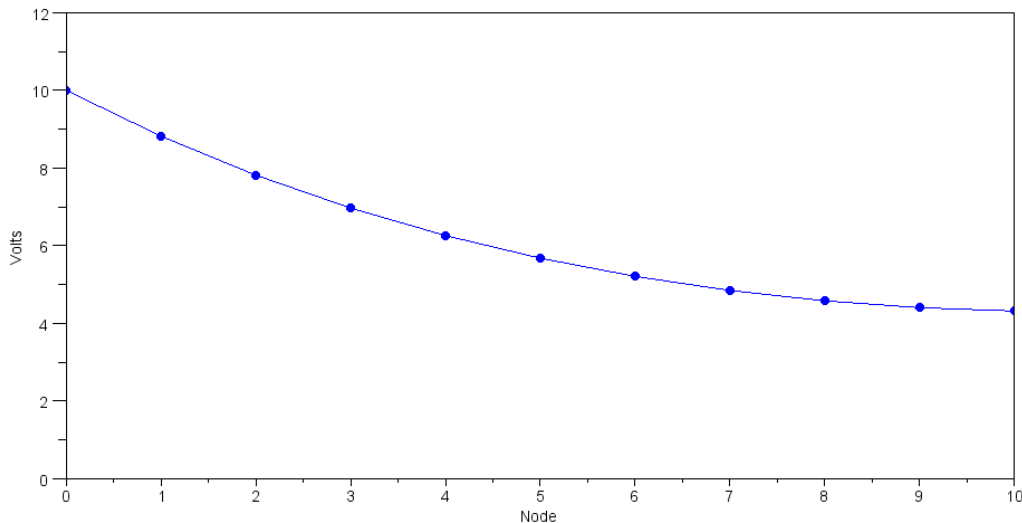
Problem 2-5: Assume a 10-stage RC filter ($V_0 \dots V_{10}$)



Problem 2) Write the dynamics for this system as a set of ten coupled differential equations:

$$I_1 = C \frac{dV_1}{dt} = \sum(\text{current to node } V_1)$$

Forced Response for a 10-Node RC Filter (heat.m):



Problem 3) Using Matlab, solve these ten differential equations for $0 < t < 5$ s assuming

- The initial voltages are zero, and
- $V_0 = 10V$.

Problem 4) Using CircuitLab, find the response of this circuit to a 10V step input. *note: It's OK if you only build this circuit to 3 nodes...*

Natural Response

Problem 5) Assume $V_0 = 0V$. Determine the initial conditions of $V_1..V_{10}$ so that

- The maximum voltage is 10V and
- 5a) The voltages go to zero as slow as possible
- 5b) The voltages go to zero as fast as possible.

Simulate the response for these initial conditions in Matlab.

Problem 6) Assume $V_{in} = 0V$. Pick random voltages for $V_1 .. V_{10}$ in the range of (0V, 10V):

$$V = 10 * \text{rand}(10,1)$$

Plot the voltages at $t = 1$. Which eigenvector does it look like?