**Homework 8**



**P18.2.4** Determine *iC* a*t* = 0+ in Figure P18.2.4, given *iSRC* = *δ*(*t*) A and assuming that the capacitor is initially uncharged.

**Solution:** The dependent source is equivalent to a conductance of 5*vC*/*vC* = 5 S, so that the total conductance is 10 S. The capacitor behaves as a short circuit in response to the impulse, which flows through the capacitor and deposits a charge of 1 C on the capacitor, resulting in a capacitor voltage of 1 V at *t* = 0+. Hence *iC*(0+) = -1×10 = -10 A.



**P18.2.6** Determine *v*1 and *v*2 for *t* = 0+ in Figure P18.2.6 given *iSRC* = 4*δ*(*t*) A and assuming initial voltages *v*1 = 1 V and *v*2 = 1 V.

**Solution:** Assume that the capacitors are initially uncharged. *Ceq* = 2 + 3×6/(3 + 6) = 4 F. The impulse flows through the *Ceq*, depositing a charge of 4 C on *Ceq*, and resulting in a charge of 4/4 = 1 V. This same voltage appears across the 2 F capacitor so that the charge on this capacitor is 2×1 = 2 C. The remaining 2 C will appear across each of the 3 F and 6 F capacitors, resulting in *v*1(0+) = 2/3 V, and *v*2(0+) = 2/6 = 1/3 V.

With initial charges on the capacitors, the charge due to the impulse will add to the initial charges on the capacitors. Since capacitor voltage is directly proportional to the capacitor charge, the voltages will add. Hence, with initial voltages, *v*1(0+) = 2/3 + 1 = 5/3 V, and *v*2(0+) = 1/3 + 1 = 4/3 V

**P18.3.2** Determine *vS*, *i*1, and *i*2 at *t* = 0+ in Figure P18.3.2, given *iSRC* = *δ*(*t*) μA and assuming that the inductors: (a) are initially uncharged, and (b) have initial currents *I*10 = *I*20 = 2 mA.



**Solution:** (a) The current impulse flows through the resistor, resulting in a voltage impulse of 10 mWb-T. This voltage impulse establishes in each of the inductors a flux linkage of 10 mWb-T. Hence, *i*1 = 10/6 = 5/3 mA, and *i*2 = 10/3 mA. The total current in the resistor is 5/3 + 10/3 = 5 mA, and *vS* at *t* = 0+ is -5×10 = -50 V.

(b) The currents due to the impulse add to the initial currents, so that, at *t* = 0+, *i*1 = 2 + 5/3 = 11/3 mA, and *i*2 = 2 + 10/3 = 16/3 mA. The total current in the resistor is 11/3 + 16/3 = 9 mA, and *vS* at *t* = 0+ is -9×10 = -90 V.

**P18.3.6** Determine *iSRC,* given that *vO* is an, impulse at the origin of strength 1 mVs, and assuming the inductors are initially uncharged.



**Solution:** If *vO* across parallel inductance of 0.5 mH is *δ*(*t*) mV, then the flux linkage is the time integral, which is *u*(*t*) mVs. The current, which is the same as *iSRC*, is therefore *u*(*t*) mVs/0.5 mH = 2*u*(*t*) A.



**P18.4.2** Determine *iL* and *vC* at *t* = 0+ in Figure P18.4.2, given *vSRC* = 20*δ*(*t*) μV, and assuming the inductor and capacitor are initially uncharged.

**Solution:** The inductor presents an open circuit to the impulse and the capacitor a short circuit. The impulse therefore appears across *L* and establishes a flux linkage of 20 μWb-T, resulting in current at *t* = 0+ of 20/2 = 10 A. This current is a step current through the capacitor, so that *vC*(0+) = 0.