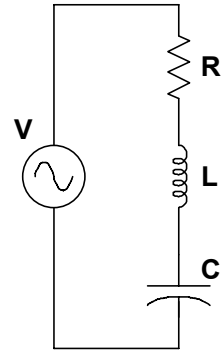


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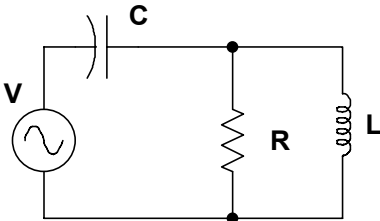
Supplementary Problems, AC Circuits

1. For the circuit shown, $V = 20V @ f=(2 \times 10^4 \text{ Hz})/\pi$, $R = 500\Omega$, $L = 125mH$, and $C = 0.005 \mu F$.

- Calculate the current in R; {ans.: 40 ma}
- Calculate the current in L; {ans.: 40 ma}
- Calculate the current in C; {ans.: 40 ma}
- Calculate the voltages across R, L, and C.
{ans.: $V_R=20V$; $V_L=j200V$; $V_C= -j200V$ }



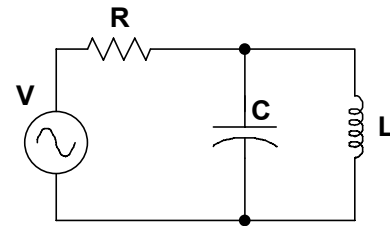
2. For the circuit shown, $V = 25V @ f=(5 \times 10^4 \text{ Hz})/\pi$, $R = 5 \text{ k}\Omega$, $L = 25mH$, and $C = 0.002 \mu F$.



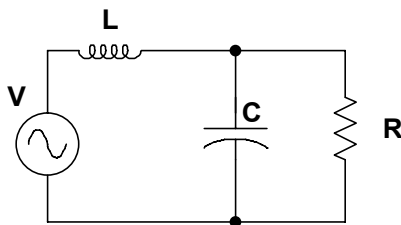
- Calculate the current in R; {ans.: $2.5(-1+j) \text{ ma}$ }
- Calculate the current in L; {ans.: $5(1+j) \text{ ma}$ }
- Calculate the current in C; {ans.: $2.5(1-j3) \text{ ma}$ }
- Calculate the voltages across R, L, and C.
{ans.: $V_R=12.5(-1+j)V$; $V_L=12.5(-1+j)V$; $V_C= 12.5(3-j)V$ }

3. For the circuit shown, $V = 15V @ f=(1 \times 10^4 \text{ Hz})/\pi$, $R = 2 \text{ k}\Omega$, $L = 250mH$, and $C = 0.005 \mu F$.

- Calculate the current in R; {ans.: $(0.28-j1.4) \text{ ma}$ }
- Calculate the current in L; {ans.: $(0.56-j2.8) \text{ ma}$ }
- Calculate the current in C; {ans.: $(-0.28+j1.4) \text{ ma}$ }
- Calculate the voltages across R, L, and C.
{ans.: $V_R=(0.56-j2.8)V$; $V_L=(14.4+j2.8)V$; $V_C=(14.4+j2.8)V$ }



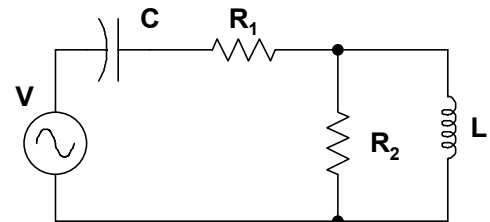
4. For the circuit shown, $V = 10V @ f=(2 \times 10^4 \text{ Hz})/\pi$, $R = 500\Omega$, $L = 20mH$, and $C = 0.04 \mu F$.



- Calculate the current in R; {ans.: $(-2.12-j12.1) \text{ ma}$ }
- Calculate the current in L; {ans.: $(7.58-j13.8) \text{ ma}$ }
- Calculate the current in C; {ans.: $(9.7-j1.7) \text{ ma}$ }
- Calculate the voltages across R, L, and C.
{ans.: $V_R=(-1.0-j6.1)V$; $V_L=(11.0+j6.1)V$; $V_C=(-1.0-j6.1)V$ }

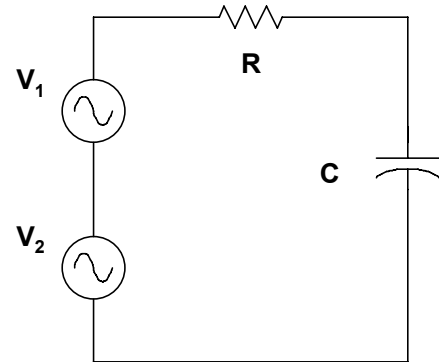
5. For the circuit shown, $V = 20V @ f=(2 \times 10^4 \text{ Hz})/\pi$, $R_1 = 1.5 \text{ k}\Omega$, $R_2 = 0.5 \text{ k}\Omega$, $L = 37.5mH$, and $C = 0.025 \mu F$.

- Calculate the current in R_1 and R_2 ; {ans.: $I_{R_1}=(8.6+j3.8) \text{ ma}$; $I_{R_2}=(6.6+j6.0) \text{ ma}$; }
- Calculate the current in L; {ans.: $(2.0-j2.2) \text{ ma}$ }
- Calculate the current in C; {ans.: $(8.6+j3.8) \text{ ma}$ }
- Calculate the voltages across R_1 , R_2 , L, and C. {ans.: $V_{R_1}=(12.9+j5.6) \text{ V}$; $V_{R_2}=(3.3+j3.0) \text{ V}$; $V_L=(3.3+j3.0)V$; $V_C=(3.8-j8.6) \text{ V}$ }

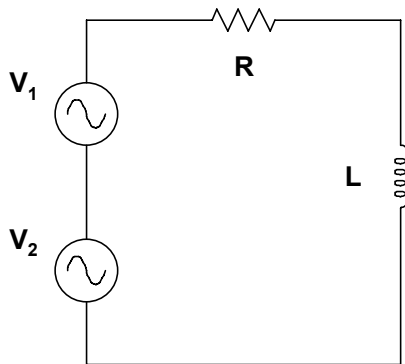


6. For the circuit shown, $V_1 = 2V @ f_1 = (1 \times 10^5 \text{ Hz})/2\pi$, $V_2 = 1V @ f_2 = (5 \times 10^3 \text{ Hz})/2\pi$, $R = 2 \text{ k}\Omega$, and $C = 0.05 \mu\text{F}$.

- Calculate the current in R at f_1 and f_2 ; {ans.: @ f_1 , $I = (2.0 + j0.2) \text{ ma}$; @ f_2 , $I = (0.1 + j0.2) \text{ ma}$ }
- Calculate the current in C at f_1 and f_2 ; {ans.: @ f_1 , $I = (2.0 + j0.2) \text{ ma}$; @ f_2 , $I = (0.1 + j0.2) \text{ ma}$ }
- Calculate the voltage across C at f_1 and at f_2 ; {ans.: @ f_1 , $V_C = (0.02 - j0.2) \text{ V}$; @ f_2 , $V_C = (0.8 - j0.4) \text{ V}$ }
- Calculate the ratios $|V_C/V_1|$ at f_1 and $|V_C/V_2|$ at f_2 . (Note that these are magnitudes!) {ans.: @ f_1 , $|V_C/V_1| = 0.89$; @ f_2 , $|V_C/V_2| = 0.2$ }



7. For the circuit shown, $V_1 = 2V @ f_1 = (2 \times 10^3 \text{ Hz})/\pi$, $V_2 = 1V @ f_2 = (1 \times 10^5 \text{ Hz})/\pi$, $R = 0.5 \text{ k}\Omega$, and $L = 12.5 \text{ mH}$.



- Calculate the current in R at f_1 and f_2 ; {ans.: @ f_1 , $I = (4.0 - j0.4) \text{ ma}$; @ f_2 , $I = (0.28 - j0.7) \text{ ma}$ }
- Calculate the current in L at f_1 and f_2 ; {ans.: @ f_1 , $I = (4.0 - j0.4) \text{ ma}$; @ f_2 , $I = (0.28 - j0.7) \text{ ma}$ }
- Calculate the voltage across L at f_1 and f_2 ; {ans.: @ f_1 , $V_L = (0.02 + j0.2) \text{ V}$; @ f_2 , $V_L = (0.86 + j0.34) \text{ V}$ }
- Calculate the ratios $|V_L/V_1|$ at f_1 and $|V_L/V_2|$ at f_2 . (Note that these are magnitudes!) {ans.: @ f_1 , $|V_L/V_1| = 0.1$; @ f_2 , $|V_L/V_2| = 0.93$ }