Alexander & Sadiku Example Problem 10.6
Michael Gustafson

```
> restart
```

**Handy functions for dealing with phasors**

```
> j := I:
> polard := (mag, angd) → polar(mag, angd*Pi/180) :
> argumentd := (num) → argument(num)*180/Pi :
> listphasors :=proc(plist) local k
  for k from 1 to nops(plist[ ]) do
  printf("%s = %f < %f deg\n", lhs(plist[ ][k]), evalc(abs(rhs(plist[ ][k]))),
       evalc(argumentd(rhs(plist[ ][k]))))
   end do end proc:
```

**Circuit equations**

$$> KCLn2 := \frac{(Vn2 - Va)}{jomega \cdot L} - Ib + \frac{Vo}{R1} = 0 :$$

$$> KCLn3 := -\frac{Vo}{R1} + jomega \cdot C \cdot (Vn2 - Vo) + \frac{(Vn2 - Vo - Vc)}{R2} = 0 :$$

**Solve circuit equations**

$$> MySoln := solve(\{KCLn2, KCLn3\}, [Vn2, Vo]) :$$

$$> collect(MySoln, jomega)$$

$$\left[\left[Vn2 = \left(C\,Ib\,L\,R1\,R2\,jomega^2 + (C\,R1\,R2\,Va + Ib\,L\,R1 + Ib\,L\,R2 + L\,Vc)\,jomega + R1\,Va + R2\,Va\right) \Big/ \left(C\,L\,R2\,jomega^2 + (C\,R1\,R2 + L)\,jomega + R1 + R2\right), Vo = \frac{R1\left(C\,Ib\,L\,R2\,jomega^2 + (C\,R2\,Va + Ib\,L)\,jomega + Va - Vc\right)}{C\,L\,R2\,jomega^2 + (C\,R1\,R2 + L)\,jomega + R1 + R2}\right]\right] \quad \textbf{(1)}$$

**Define lists for elements, then for each frequency independently**

$$> ElVals := R1 = 1, R2 = 4, L = 2, C = 0.1 :$$

$$> Valsa := ElVals, jomega = j \cdot 2, Va = polard(10, 0), Ib = 0, Vc = 0 :$$

$$> Valsb := ElVals, jomega = j \cdot 5, Va = 0, Ib = polard(2, -90), Vc = 0 :$$

$$> Valsc := ElVals, jomega = j \cdot 0, Va = 0, Ib = 0, Vc = polard(5, 0) :$$

**Find solutions for each frequency**

```
> MySolna := subs(Valsa, MySoln) :
> MySolnb := subs(Valsb, MySoln) :
> MySolnc := subs(Valsc, MySoln) :
```

**Find phasors for each frequency**

```
> listphasors(MySolna)
Vn2 = 9.877484 < -60.353678 deg
Vo = 2.498097 < -30.784147 deg
> listphasors(MySolnb)
Vn2 = 5.606810 < -119.538782 deg
Vo = 2.328101 < -77.905243 deg
> listphasors(MySolnc)
```

```
Vn2 = 0.000000 < 0.000000 deg
Vo = 1.000000 < 180.000000 deg
>
```

**Conclusion**:

$vo(t) = 2.498\cos(2\,t - 30.78\,deg) + 2.328\cos(5\,t - 77.91\,deg) - 1$