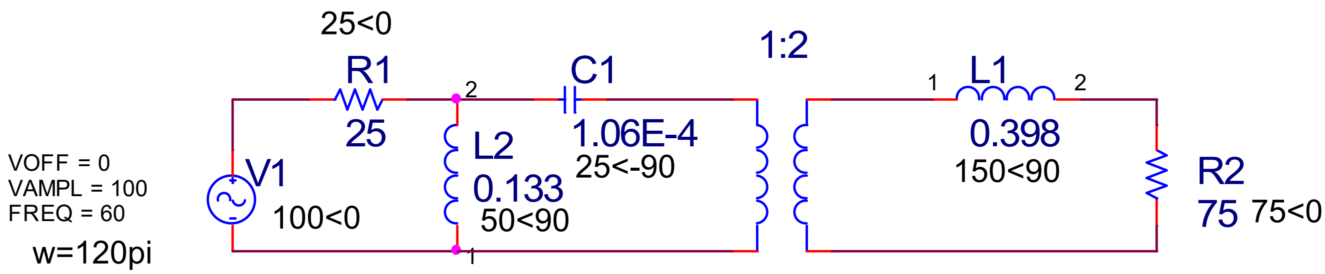
Problem 1) Ideal Transformers and Power



1.1: For the transformer circuit above, find the equivalent circuit (without a transformer with only a source impedance and load impedance). ***You may use either referral method though you should figure out which would best to use. (15 pts)***

VTH=100*50<90/(25+50<90)=89.45<26.56 Zsource=25<-36.87, Zload=167.7<63.43

1.2: Find the voltage across the R2. ***Put in phasor/polar form. (10 pts)***

V(Load)=178.49<26.56, Z(source equiv)=100<-36.87, Z(total)=179<30.14, I=V(Load)/Z(total)=0.998<-3.57

VR2=I*ZR2=.998<-3.57*75=74.85<-3.57

equiv VTH ZTH:	V1=89.44<26.56	Zs=25<-36.87	Zl=167.71<63.43
ref to primary:	same 89	same 25	/N^2 Zl=41.93<63.43
ref to secondary	*N 178.89	*N^2 100	same 167.7

phases stay the same

complex power disipated in: V1=Vtot*R1/(R1+R2), I1=Vtot/Rtot, P1=I*V1

primary:

V1=89*25/(25+41)=49.90<-40.45 I1=89/(25+41)=1.996<-3.57 P1=1.9*49=99.61<-44.02

secondary:

V2=178*167.7/(167.7+100)=167.37<59.86 I2=178/(100+167.7)=0.998<-3.57 P2=0.998*167.3=167.05<56.28

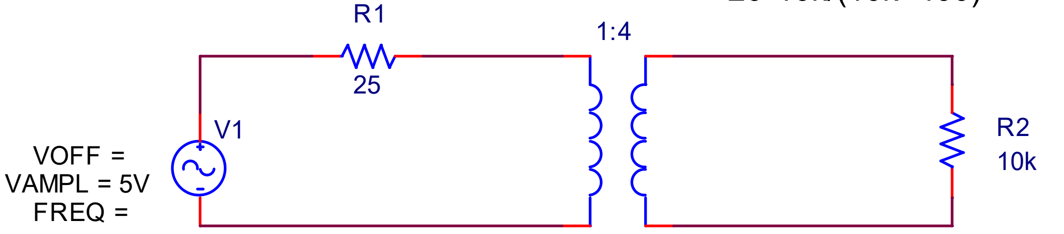
double check?

P1+P2=99.61+167.05=178.54<22.99 P1+P2=Pgen

Pgen=I1*V=1.996*89.44=178.53<22.99

Problem 2) Real Transformers

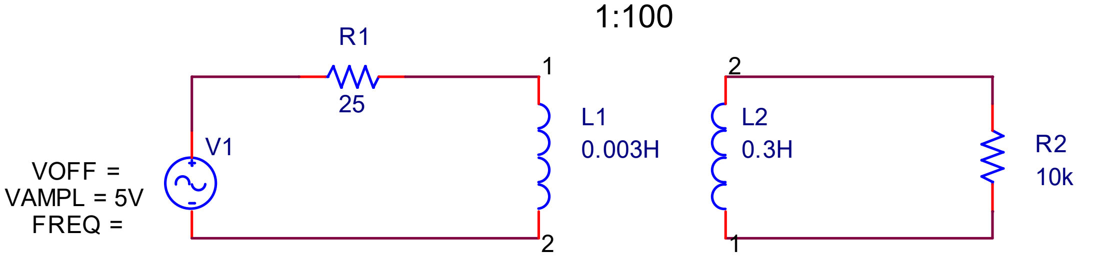
400 20*10k/(10k+400)



20V 19.23<0 it's ideal?

2.1: Determine the voltage across R2 in phasor form

1:100



$M = k \cdot \sqrt{L_1 \cdot L_2}$ =.024

2.2: If the real transformer is constructed of two inductors (as show) and the coupling coefficient is k=0.8, determine the Tee model of the circuit. Draw your circuit.

25 ohm -.021 .276H

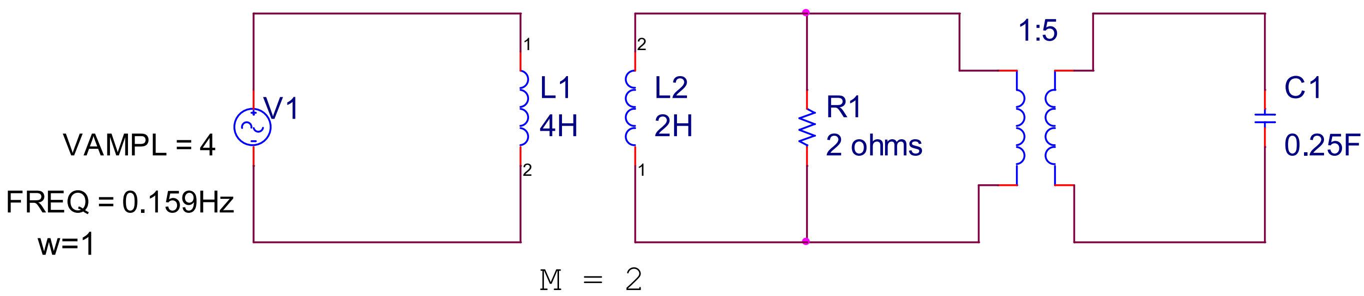
1 2 2 1 2

.024H 10k ohm

5V

1

Problem 3) Real and Ideal Transformers



In the above circuit, L1 and L2 are coupled by the mutual inductance, M. The voltage source has a voltage V1(t) = 4 cos(t) (ω= 1 rad/s). The the transformer on the right is an ideal transformer.

3.1. Draw the equivalent circuit without transformers (should include only a source impedance and a load impedance with values) ***(15 pts)***. *Note: Draw the equivalent circuit so you can easily calculate current through C1. Include all calculations and supporting diagrams along the way.*

3.2: Determine the current through C1. ***Put in time domain form.***

2H ~~0H~~ 1:5

4V<0 2H 2ohm .25F

2<90 1:5

4V<0 2<90 2<0 .25<-90

20V<0 4.25<61.927 ohms

.894<63.43 1:5

4V<0 .25<-90

4.47<63.43

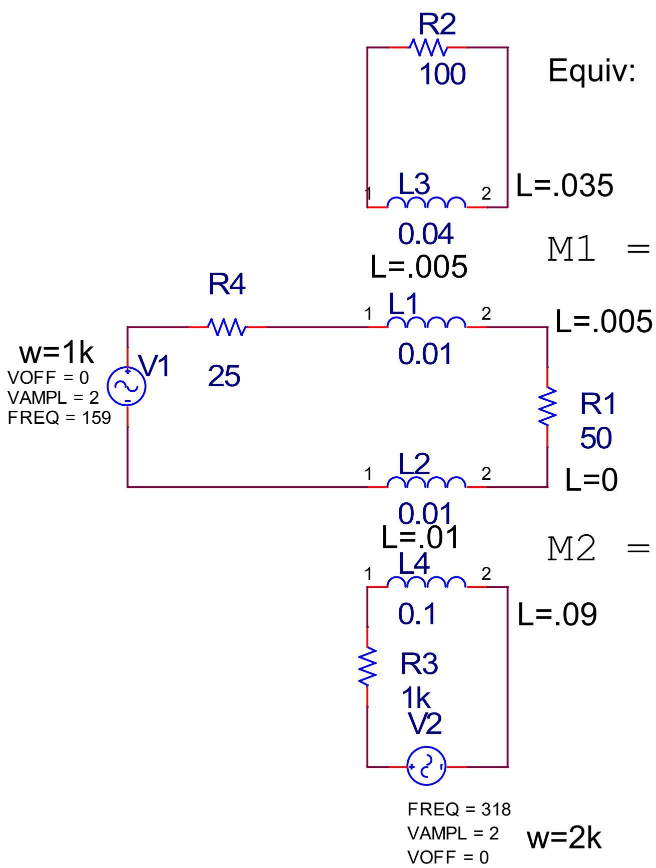
20V<0 .25<-90

I=V/Z=4.706<-61.9275

I=4.706sin(t-1.0808) (in rad)

I=4.706sin(t-61.92) (in deg)

Problem 4) Mutual Inductance



Find the current and voltage through R1 in the above couple circuits. There are two locations with inductive coupling and both sets have additive coupling. Additionally, there are two voltage sources with different excitation frequencies. Suggestion, use superposition in your analysis.

superposition f=159 w=1k

4.919<87.48

105.94<19.29

~~100~~

35<90

25

5<90

52.475<16.50+5<90=54.108<21.58

5<90

2<0V

~~50~~

I=V/Z=2<0/54.108<21.58=0.036963<-21.58

10<90

VR=V*ZR/Ztot=2*50/54.108<21.58=1.848<-21.583

~~1k~~ 90<90 9.99<89.4

V/I=50 ✓

10004<5.14