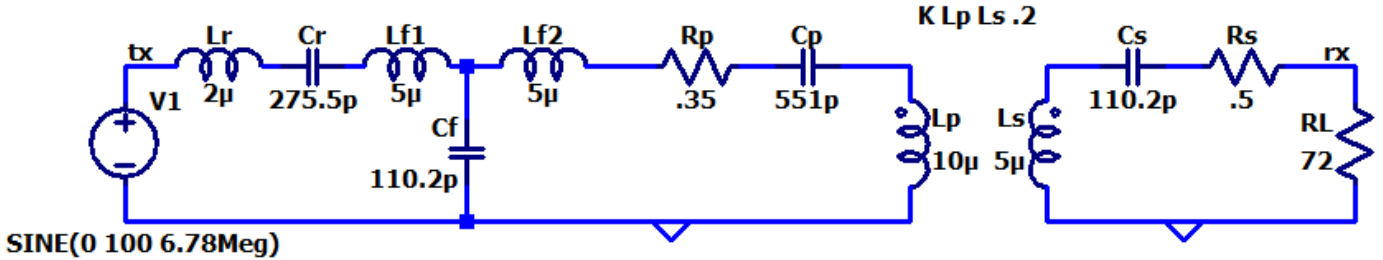
# Numerical Example




**MATLAB Code:**

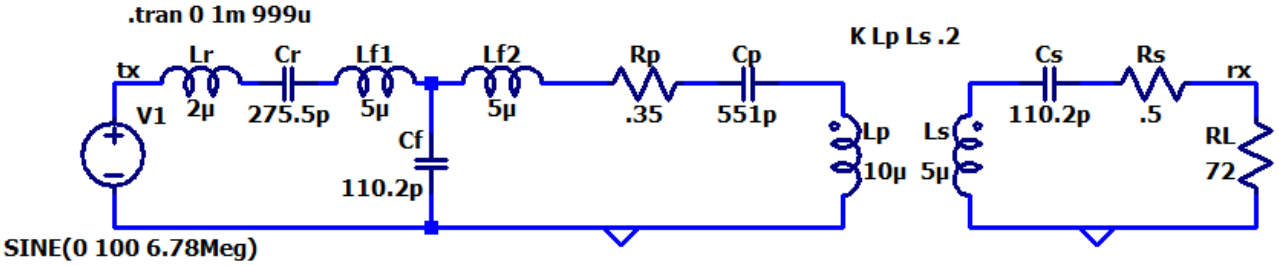
```
f = 6.78e6;          % Sinusoidal frequency [Hz]
w = 2*pi*f;          % Sinusoidal frequency [rad/sec]
VTX = 100*exp(-1i*pi/2); % Transmitter Voltage Phasor

Lr = 2e-6;
Cr = 1/w^2/Lr;

Lf1 = 5e-6;
Lf2 = Lf1;
Cf = 1/w^2/Lf1;

Rp = .35;
Lp = 10e-6;
Cp = 1/w^2/Lp;

k = .2;
M = k*sqrt(Lp*Ls);

Ls = 5e-6;
Cs = 1/w^2/Ls;
Rs = .5;

RL = 72;
```

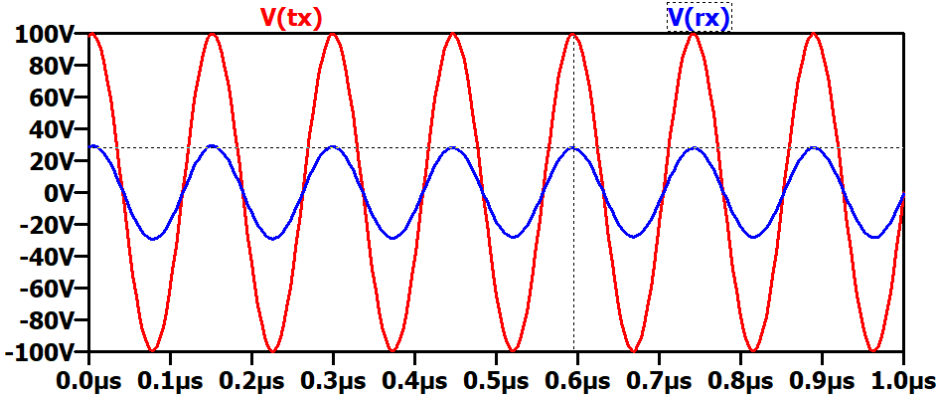
```
Z1 = 1j*(w*Lr + w*Lf1 - 1/w/Cr);
Z2 = -1j/w/Cf;
Z3 = Rp + 1j*(w*Lf2 - 1/w/Cp) + 1j*w*(Lp-M);
Z4 = 1j*w*M;
Z5 = Rs + 1j*w*(Ls-M) -1j/w/Cs;
ZL = RL;

Za = 1/(1/Z4 + 1/(Z3 + (Z1*Z2/(Z1+Z2)))); % Z4 || (Z3 + Z1||Z2)
Va = VTX/Z1  * (Z1*Z2/(Z1+Z2))  /  (Z3 + (Z1*Z2/(Z1+Z2))) * Za;

VRX = Va*(RL/(RL+Z5+Za))

mag = abs(VRX)
phase = angle(VRX)/pi*180
```

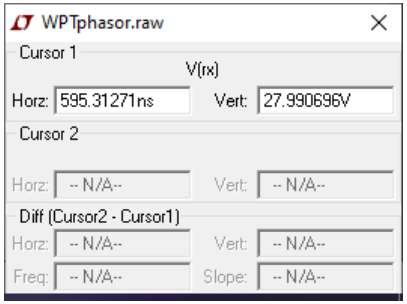
mag =
28.0892

phase =
-90.0000

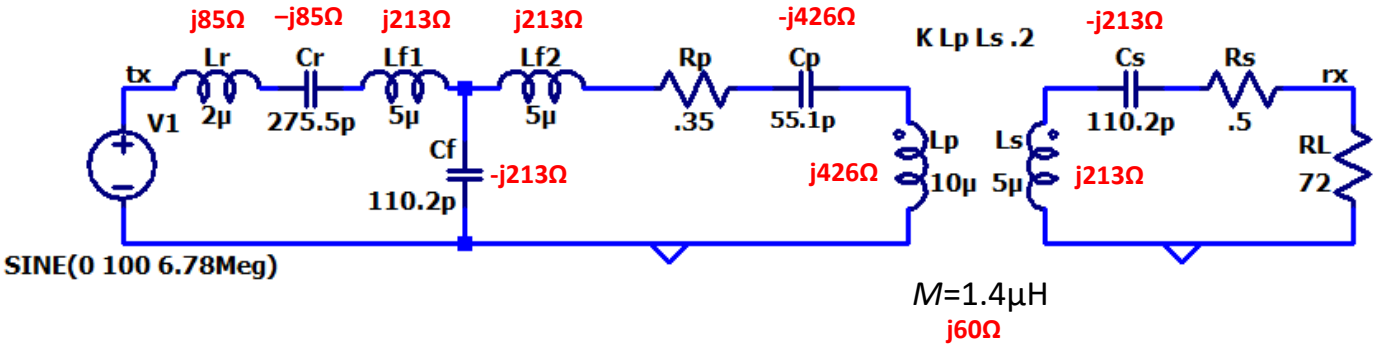
# Circuit Simulation



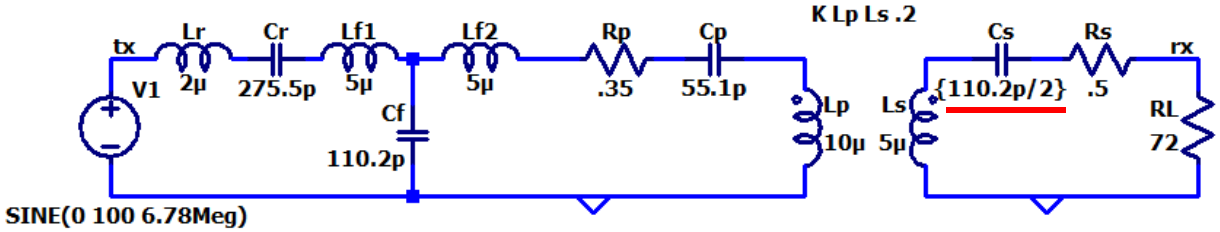



# Resonance


j85Ω
−j85Ω
j213Ω
j213Ω
-j426Ω
K Lp Ls .2
-j213Ω
tx
Lr
Cr
Lf1
Lf2
Rp
Cp
Cs
Rs
rx
V1
2µ
275.5p
5µ
5µ
.35
55.1p
110.2p
.5
Cf
-j213Ω
j426Ω
Lp
Ls
RL
110.2p
10µ
5µ
j213Ω
72
SINE(0 100 6.78Meg)
M=1.4µH
j60Ω

# Numerical Example 2




**MATLAB Result:**

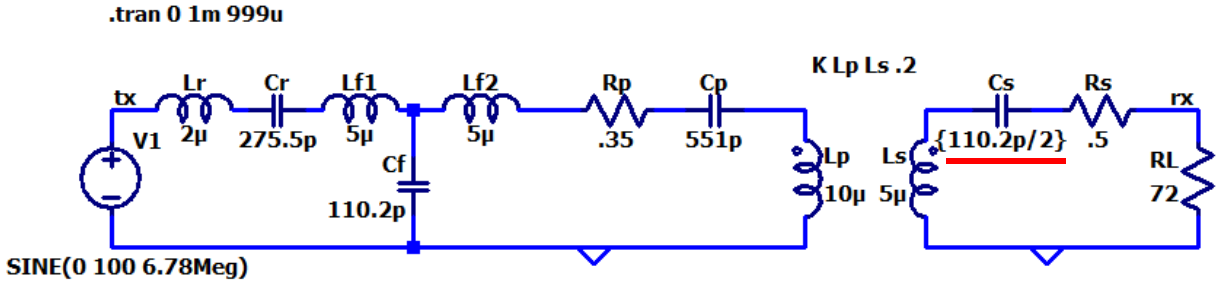
mag =

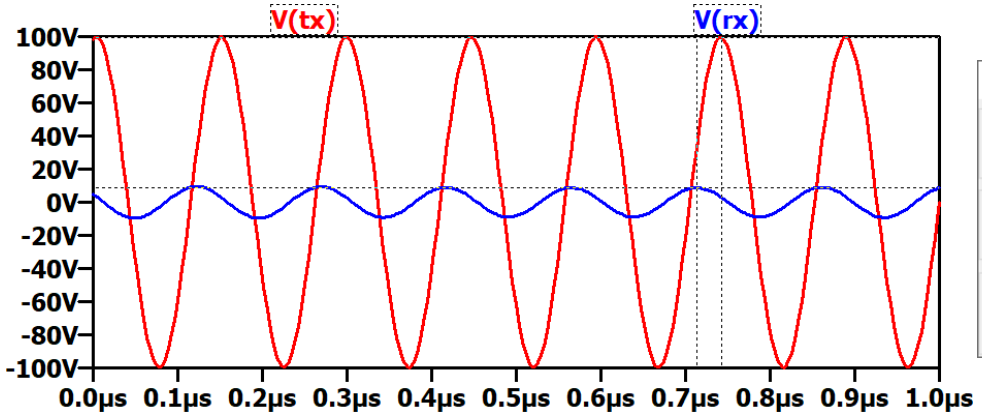
9.06

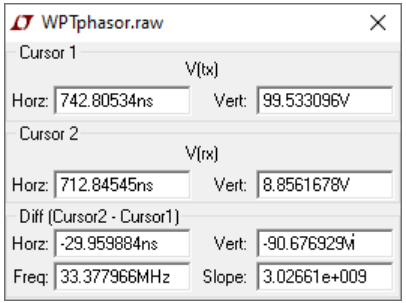
phase =

-18.7973

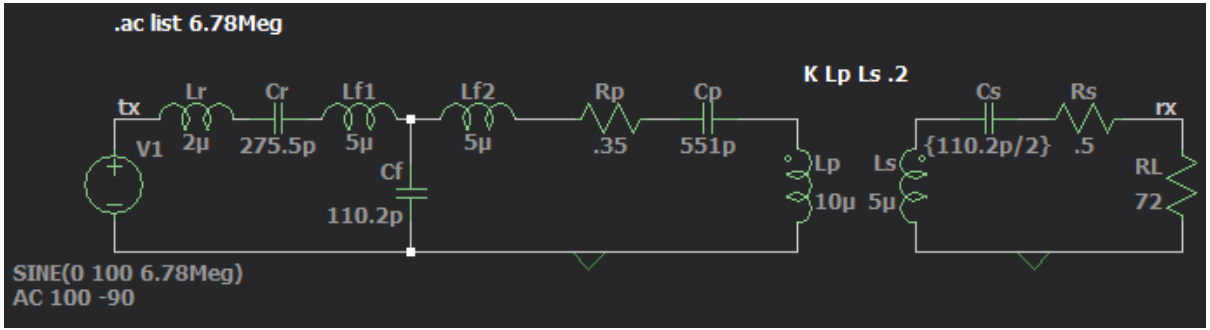
# Circuit Simulation 2

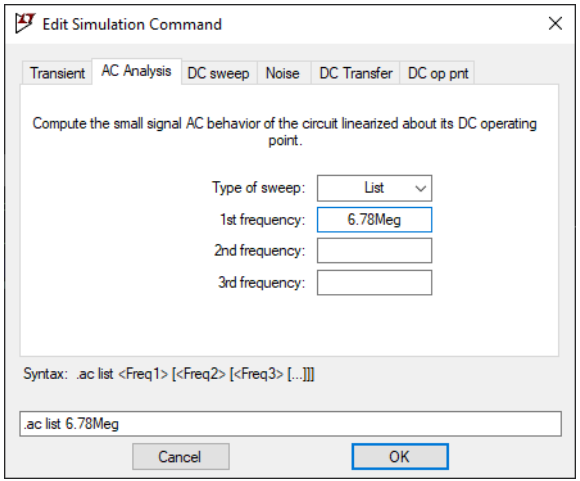


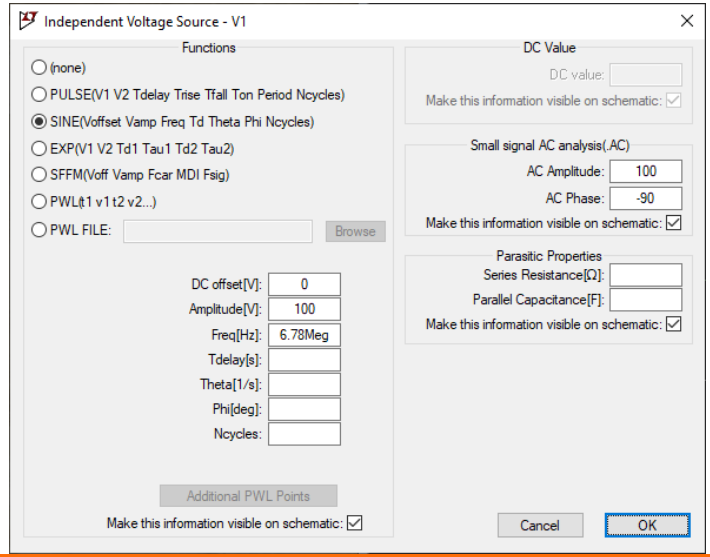



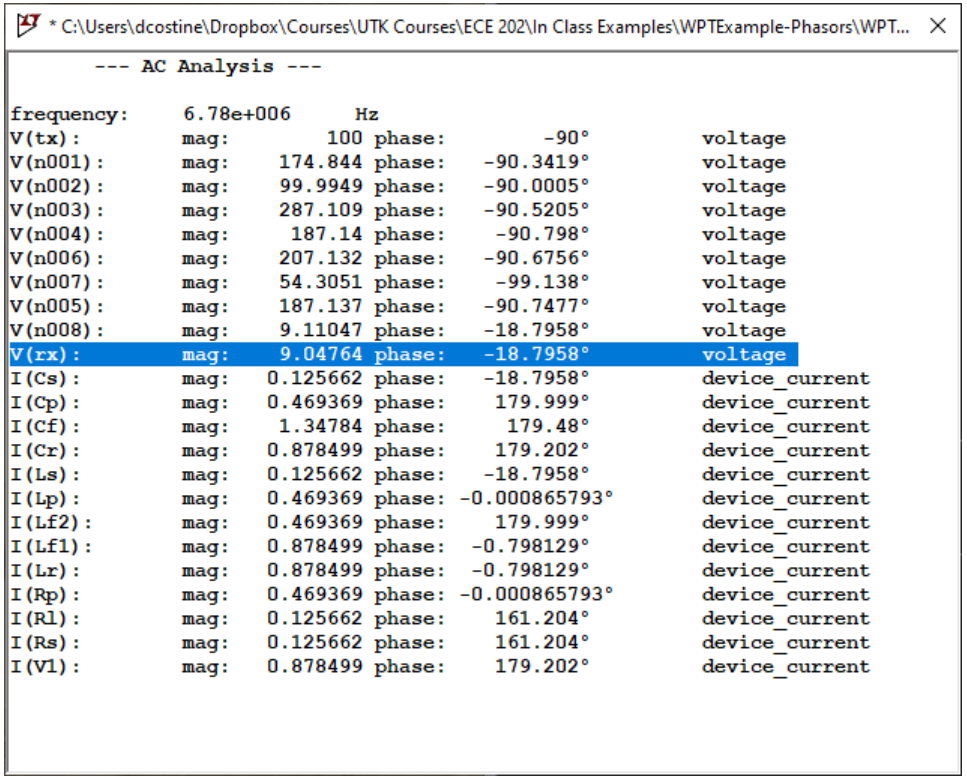
# AC Analysis


.ac list 6.78Meg
K Lp Ls .2
tx
Lr
2µ
Cr
275.5p
Lf1
5µ
Cf
110.2p
Lf2
5µ
Rp
.35
Cp
551p
Lp
10µ
Ls
5µ
Cs
{110.2p/2}
Rs
.5
rx
RL
72
V1
SINE(0 100 6.78Meg)
AC 100 -90

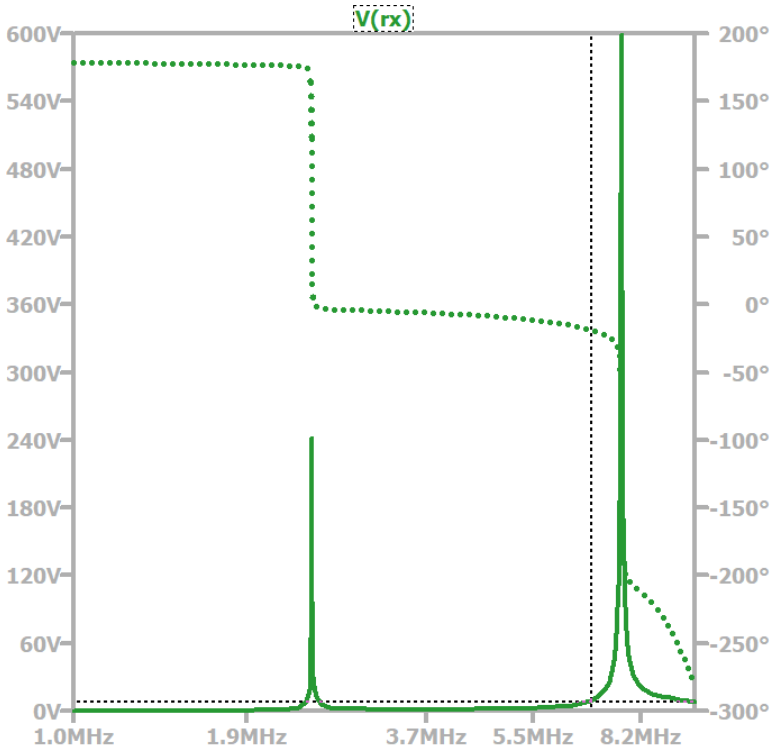

Edit Simulation Command
Transient
AC Analysis
DC sweep
Noise
DC Transfer
DC op pnt
Compute the small signal AC behavior of the circuit linearized about its DC operating point.
Type of sweep:
List
1st frequency:
6.78Meg
2nd frequency:
3rd frequency:
Syntax: .ac list <Freq1> [<Freq2> [<Freq3> [...]]]
.ac list 6.78Meg
Cancel
OK

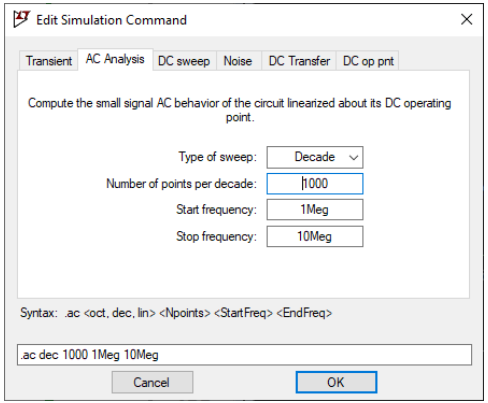

Independent Voltage Source - V1
Functions
(none)
PULSE(V1 V2 Tdelay Trise Tfall Ton Period Ncycles)
SINE(Voffset Vamp Freq Td Theta Phi Ncycles)
EXP(V1 V2 Td1 Tau1 Td2 Tau2)
SFFM(Voff Vamp Fcar MDI Fsig)
PWL(t1 v1 t2 v2...)
PWL FILE:
Browse
DC offset[V]: 0
Amplitude[V]: 100
Freq[Hz]: 6.78Meg
Tdelay[s]:
Theta[1/s]:
Phi[deg]:
Ncycles:
Additional PWL Points
Make this information visible on schematic:
DC Value
DC value:
Make this information visible on schematic:
Small signal AC analysis(.AC)
AC Amplitude: 100
AC Phase: -90
Make this information visible on schematic:
Parasitic Properties
Series Resistance[Ω]:
Parallel Capacitance[F]:
Make this information visible on schematic:
Cancel
OK

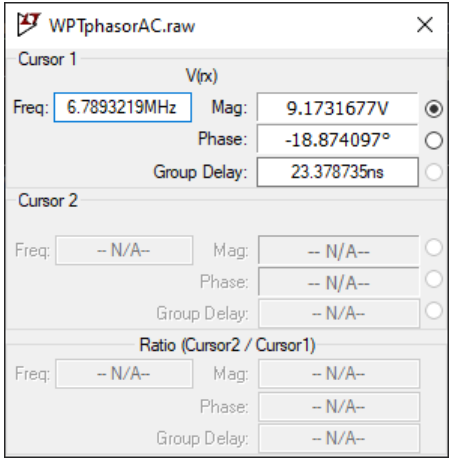
# AC Simulation Results (Single Point)



# Frequency Sweep



# Form of the solution

$$\sum_{i=0}^{N} b_i \frac{d^i}{dt^i} v_o(t) \quad = \quad \sum_{i=0}^{M} a_i \frac{d^i}{dt^i} v_i(t)$$