Nov 28, 16 15:56  resonance.sp  Page 1/1

Series and Parallel Resonant Circuits
*Uncomment the appropriate sections to alter the circuits
*and to view the results.

*series resonant circuit
  *V_src vin gnd ac 1.0 sin ;1v ac source, no dc value
  *r_src vin tiel 1.0 ;1 ohm resistor to sense current
  *r_cap tiel tie2 2nf ;2nf network cap
  *r_cap tie1 tie2 10Meg ;10Meg ohm resistor, models capacitor leakage
  *l_net tie2 tie3 1uH ;1uh network inductor
  *r_ind tie3 gnd 0.6 ;0.6 ohm, models inductor resistance

*parallel resonant circuit
  V_src vin gnd ac 1.0 sin ;1v ac source, no dc value
  r_src vin tiel 10k ;10k ohm resistor to sense voltage
  r_cap tiel gnd 10Meg ;10Meg ohm resistor, models capacitor leakage
  c_net tiel gnd 500pf ;500pf network cap
  l_net tiel tie2 2.5uH ;2.5uh network inductor
  r_ind tie2 gnd 0.6 ;0.6 ohm, models inductor resistance

*T-line parallel resonator
  *V_src vin gnd ac 1.0 sin ;1v ac source, no dc value
  *r_src vin tlin 10k ;10k ohm resistor to sense voltage
  *t_line tlin gnd tiel tie1 10s=50 ;s=5Meg NL=25  ;tline resonator
  *r_du dummy tie1 gnd 10  ;required DC path to ground for spice

..control
  set hcoutput=script
  set hcoutput=off
  set color0=rgb:00f/e
  set color0=rgb:000/0/e
  ac lin 1000 1m 10Meg

*parallel circuit measurements
  plot vm(tiel) vm(vin, tiel) ;V across and relative I through resonator
  hardcopy parallel_circuit.ps vm(tiel) vm(vin, tiel)

*series circuit measurements
  plot vm(tiel) vm(vin, tiel) ;V across and relative I through resonator
  hardcopy series_circuit.ps vm(tiel) vm(vin, tiel)

*T-line circuit measurements
  plot vm(tlin) vm(vin, tlin) ;V across and relative I through resonator
  hardcopy tline_resonator.ps vm(tiel) vm(vin, tiel)

.endc
.end

This file is downloadable from:
http://www.ece.orst.edu/~traylor/ece391/newhw/
gurman_half_behavior/solutions/resonator.sp

To run: invoke ngspice, within ngspice
  >source resonator.sp
parallel resonantckt.

Units —— \text{vm(vin, tie1)} —— \text{vm(tie1)}

![Graph showing frequency vs. voltage response with a peak at 5 MHz.](image-url)
Series resonant circuit.

Units  \( V_m(\text{vin, tie1}) \)  \( V_m(\text{tie1}) \)

frequency [MHz]
T-line resonator (looks like parallel resonator)

Units: $v_m(v_{in}, t_{l_{in}})$, $v_m(t_{l_{in}})$

Graph showing frequency vs. MHz with a peak at approximately 5 MHz.
Parallel resonant circuit with 1.6Ω resistor in series with the inductor

Units: $\text{vm}(\text{vin, tie1})$ and $\text{vm}(\text{tie1})$

$g(c)$: Lossy inductor limits the ultimate response at resonance