Curs 10 :

Diagrama Smith de admitanță :

Admitanța $Y_L = \frac{1}{Z_L}$ [S, mho]

$$Y_L = G + jS$$

G - conductanța

S - susceptanța

$$\Gamma = \frac{z_L - z_0}{z_L + z_0} = \frac{\frac{z_L}{z_0} - 1}{\frac{z_L}{z_0} + 1} = \frac{z_L - 1}{z_L + 1} \Bigg| \Rightarrow \Gamma = \frac{\frac{1}{y_L} - 1}{\frac{1}{y_L} + 1}$$

$$z_L = \frac{1}{y_L}$$

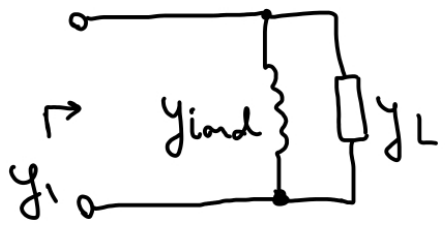
$$\Gamma = \frac{1 - y_L}{1 + y_L}$$

$$y_L = \frac{Y_L}{Y_0} = Y_L \cdot z_0 = \frac{z_0}{z_L} = \frac{1}{z_L}$$

Efectul unui inductor paralel:

Admitanța inductivă:

$$y_{ind} = \frac{1}{z_{ind}} = \frac{1}{\frac{j \cdot \omega \cdot L}{z_0}} = \frac{-j z_0}{\omega L} = -\frac{j z_0}{2\pi f L}$$



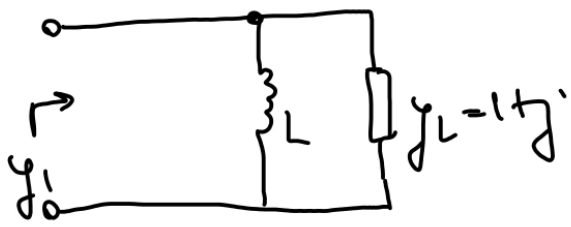
$$y_1 = y_{ind} + y_L = y_L - \frac{j z_0}{\omega L}$$

Efectul L paralel → deplasare pe cercul de conductanță constantă „counter-clockwise".

Exemplu de adaptare cu L paralel:

$y_L = 1 + j$; L=? astfel încât $y_1 = 1$

$z_0 = 50\ \Omega$; $f = 850$ MHz.



$$y_1 = y_L + y_{ind} = 1$$

$$y_L + y_{ind} = 1$$

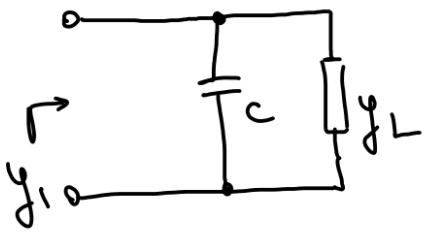
$$1 + j - j\frac{z_0}{\omega L} = 1$$

$$-j\frac{z_0}{\omega L} = -j$$

$$z_0 = \omega L \Rightarrow L = \frac{z_0}{\omega} = \frac{50\ \Omega}{2\pi \times 850 \times 10^6} = 9.36\ nH$$

Efectul capacității paralel:

$$y_C = \frac{1}{z_C} = j \cdot z_0 \cdot \omega C$$



$$y_1 = y_L + y_C$$

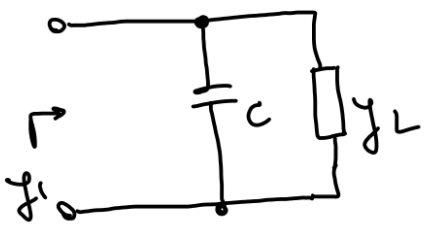
$$y_1 = y_L + j z_0 \omega C$$

Efectul C paralel: deplasare pe cercul de conductanță constantă „clockwise"

Exemplu de adaptare cu C paralel:

$y_L = 0.3 - j0.5$ C = ? astfel încât $y_L = 0.3$

$z_0 = 50\ \Omega$; $f = 2.4\ GHz$.



$$y_1 = y_L + y_C = 0.3$$

$$\cancel{0} - j \cdot 0.5 + j z_0 \omega C = \cancel{0}$$

$$j z_0 \omega C = j 0.5$$

$$C = \frac{0.5}{z_0 \cdot 2\pi \cdot f} = \frac{0.5}{50 \times 2\pi \times 2.4} \times 10^{-9} =$$

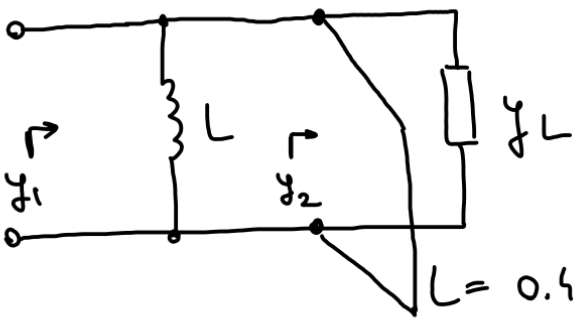
$$= 6.63 \times 10^{-4} \times 10^{-9} = 6.63 \times 10^{-13}\ F =$$

$$= 0.66\ pF$$

Adaptarea cu linii de transmisie de scurt :

$y_L = 0.3 + j \cdot 0.5$ $\qquad$ $Z_0 = 50\ \Omega$; $f = 750\ MHz$

$y_1 = 1.$



$L = 0.428\lambda - 0.328\lambda = 0.1\lambda$

$y_2 = 1 + 1.6j$ $\qquad$ $y_1 = y_2 + y_{ind} = 1$

$$1 + 1.6j - \frac{jZ_0}{\omega L} = 1$$

$$1.6j = j\frac{Z_0}{\omega L} \Rightarrow L = \frac{Z_0}{1.6\,\omega}$$

$$L = \frac{50}{2\pi \times 1.6 \times 750} \times 10^{-6}$$

$$L = 6.63\ nH$$

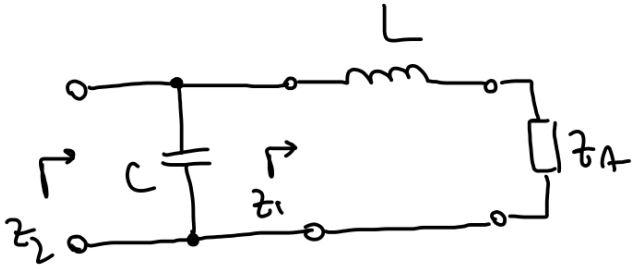
Adaptarea de impedanță fără linii de transmisie:

ex: $z_A = 0.1 - j0.2$ adaptați z_A fără linii de transmisie.

↳ diagrama Smith de impedanță

$f = 1\,GHz$

$z_0 = 50\,\Omega$



$z_1 = 0.1 + j0.3 = z_A + z_{ind}$

$0.1 + j0.3 = 0.1 - j0.2 + \frac{j\omega L}{z_0}$

$j0.3 = j\left(\frac{\omega L}{z_0} - 0.2\right)$

$\frac{\omega L}{z_0} - 0.2 = 0.3$

$\frac{\omega L}{z_0} = 0.5$

$L = \frac{0.5 \cdot 50}{2\pi \cdot} \times 10^{-9} = 3.98\,nH$

$y_2 = y_1 + y_c = 1$

$1 - 3j + y_c = 1$

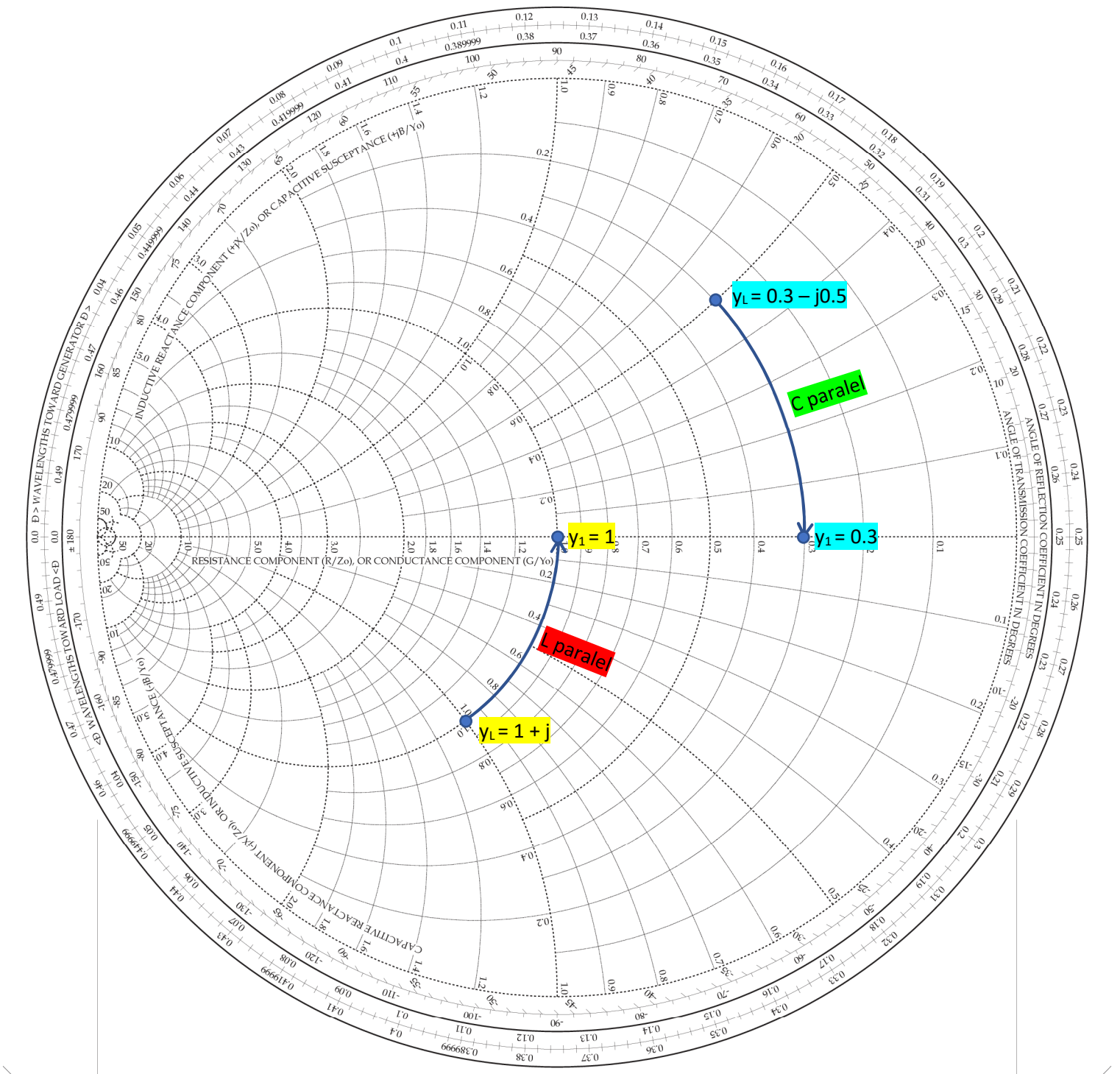
$y_c = 3j$

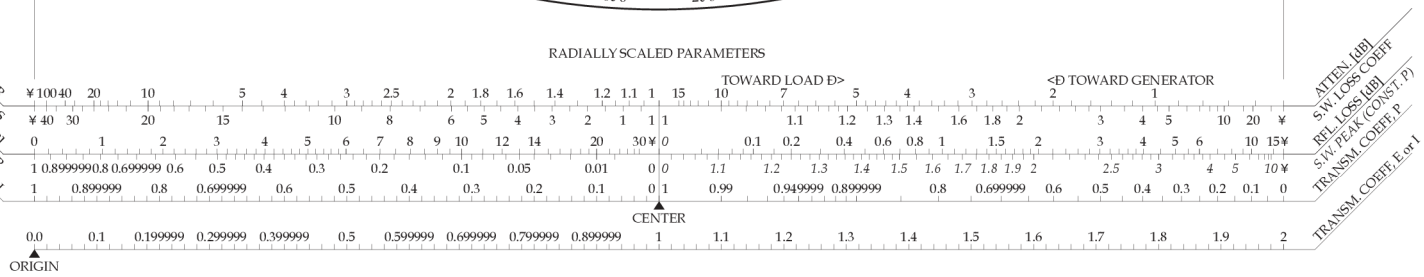
$jz_0\omega C = 3j \Rightarrow C = \frac{3}{z_0 \cdot \omega} = \frac{3}{2\pi \cdot 50} \times 10^{-9}$

$C = 9.55\,pF$

ADMITTANCE SMITH CHART

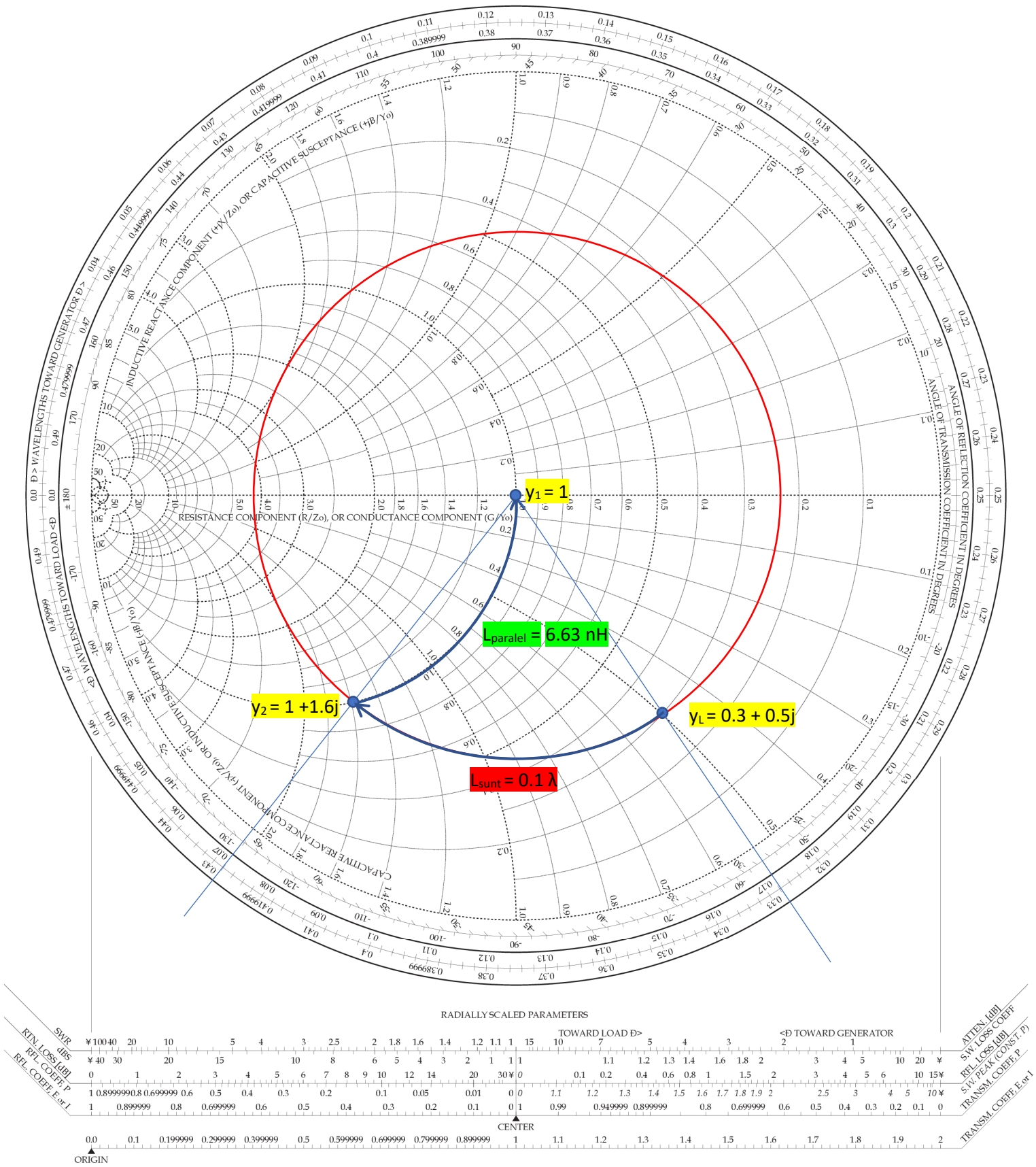
Introduction to RF Circuit Design





ADMITTANCE SMITH CHART

Introduction to RF Circuit Design



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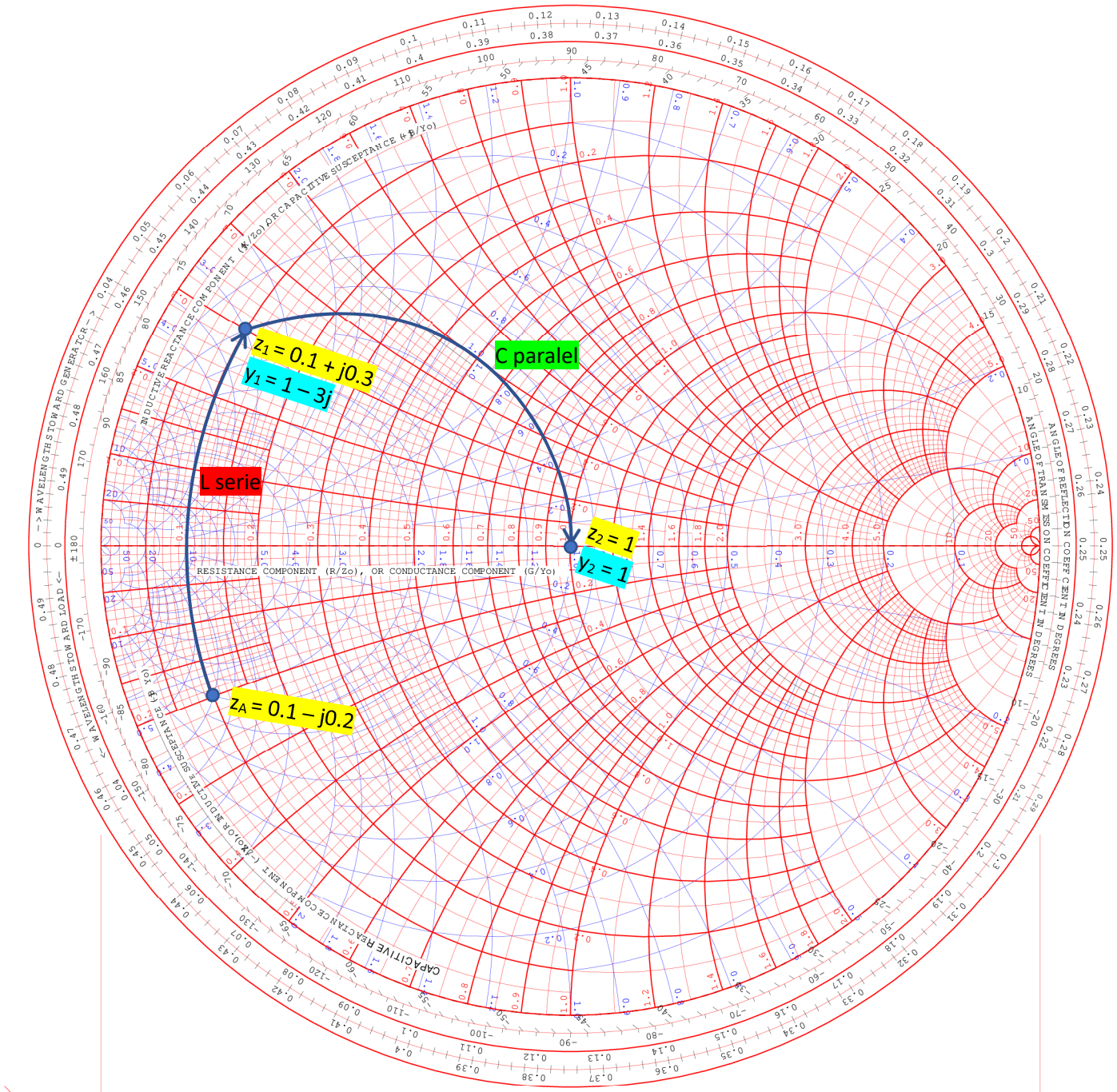
NORMALIZED IMPEDANCE AND ADMITTANCE COORDINATES



RADIALLY SCALED PARAMETERS