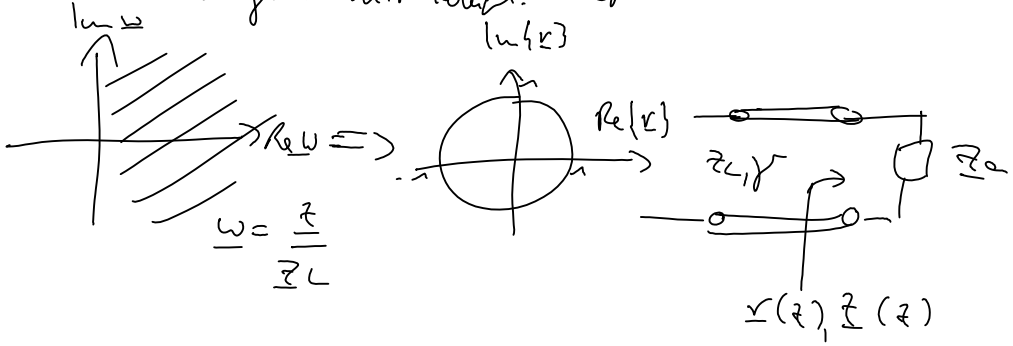
1a) $Z_i = Z_L^*$ um max. Leistung P abzugeben
(verfügb. Leistung P_{verf}) oder $r_G = r_i^*$

$$P_{max} = P_{verf} = \frac{|U_q|^2}{8 \cdot \mathrm{Re}\{Z_i\}}$$

b) Transformation von komplexen Größen,
Rechnungen mit komplexen Größen



c.) $$\underline{z}(z) = \frac{Z(z) - Z_L}{Z(z) + Z_L} = \frac{\underline{w}(z) - 1}{\underline{w}(z) + 1}$$

d.) Der Anpassungsfaktor m ist ein
Maß dafür, wie gut der Abschlusswiderstand
an die Leitung angepasst ist:

$$m = \frac{1}{s} = \frac{U_{min}}{U_{max}} = \frac{1 - |\underline{r}|}{1 + |\underline{r}|}$$

Voltage Standing Wave Ratio

Komplexe Abbildung $\underline{w} \to \underline{r} = \frac{\underline{w} - 1}{\underline{w} + 1}$ (Winkeltreu)

Bei Anpassung $r = 0$, $s = 1$ und $m = 1$
Totale Reflexion $|\underline{r}| = 1$ $s = \infty$, $m = 0$

2.) $$Z_{s,E} = \frac{Z_s}{Z_E} = \frac{(5 + 5j)\,\Omega}{50\,\Omega}$$

$$= (0{,}1 + 0{,}1j)\,\Omega$$

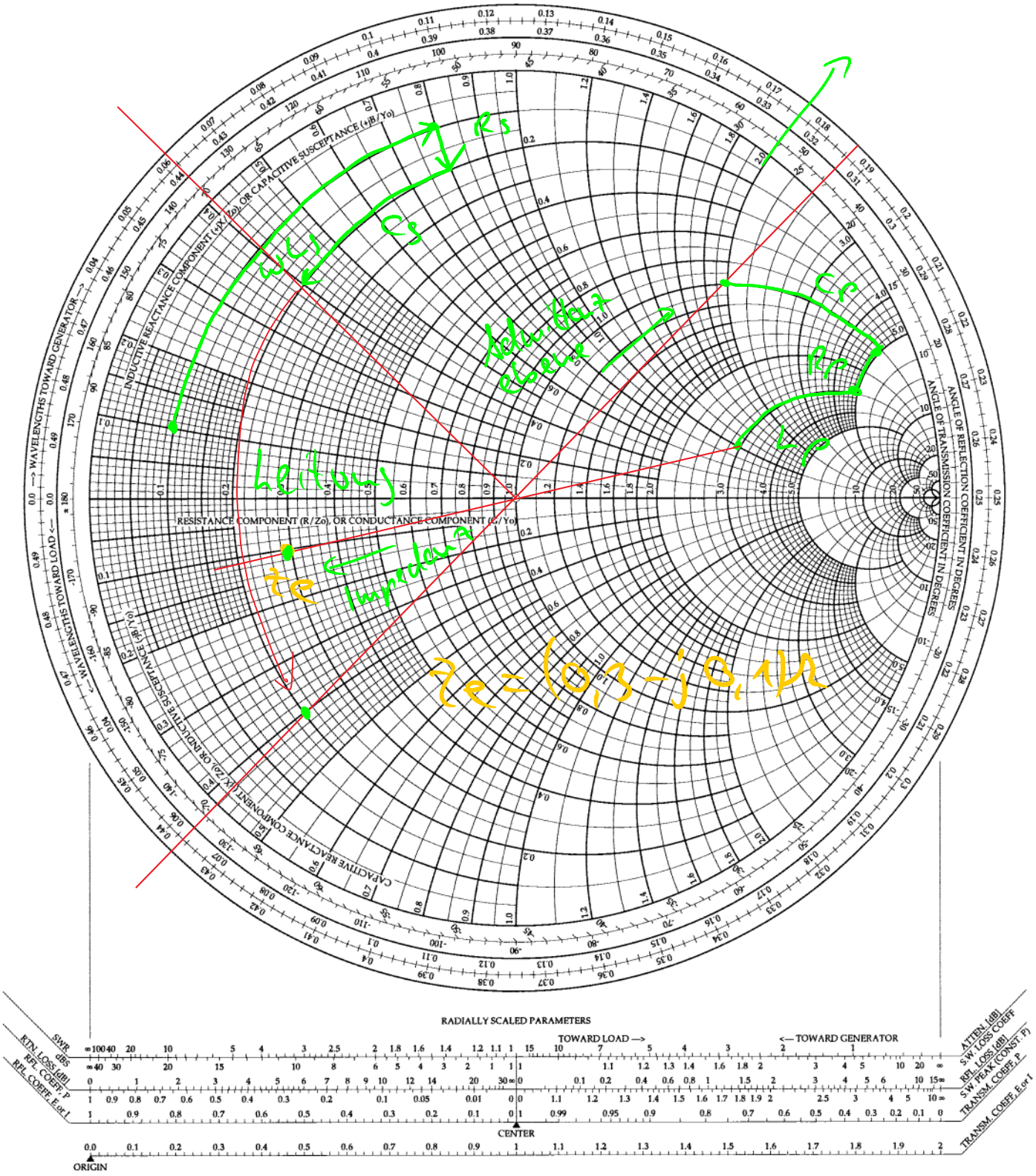
$$\frac{j\omega L_S}{Z_L} = \frac{35\,\Omega}{50\,\Omega} = \frac{7}{10}\,\Omega$$

$$\frac{R_S}{Z_L} = \frac{5\,\Omega}{50\,\Omega} = 0{,}1\,\Omega$$

$$\frac{1}{j\omega C_S} \cdot \frac{1}{Z_L} = -\frac{20\,\Omega}{50\,\Omega} = -0{,}4\,\Omega$$

The Complete Smith Chart

Black Magic Design



$\frac{L}{\lambda} = 0{,}335$

$0{,}062 + 0{,}335 = 0{,}437$

C_p: $\left(\frac{1}{j\omega C_p} \cdot \frac{1}{Z_L}\right)^{-1} = j\omega C_p \cdot Z_L$

$= j\frac{3}{50} \cdot 50\,\Omega$

R_p ∥ $\left(\frac{25\,\Omega}{50\,\Omega}\right)^{-1} = 2\,\Omega$

L_p: $\left(\frac{j\omega L_p}{Z_L}\right)^{-1} = -j\frac{50}{12{,}5} = -4j$

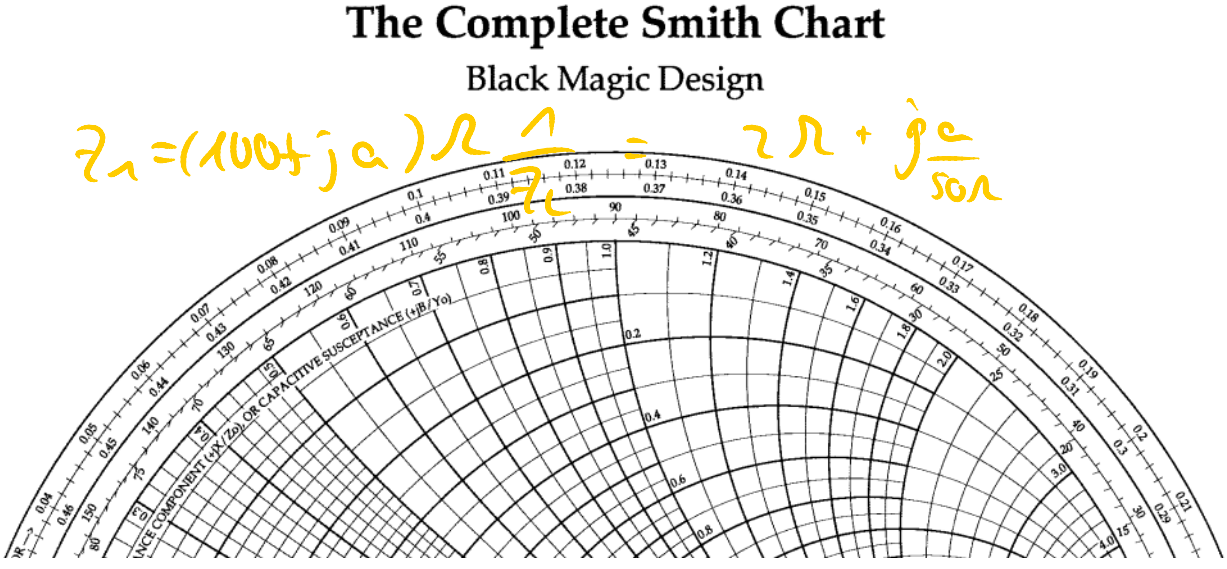
$Z_e = (0{,}3 - j0{,}1)\,\Omega \cdot Z_L$

$= 15\,\Omega - j5\,\Omega$

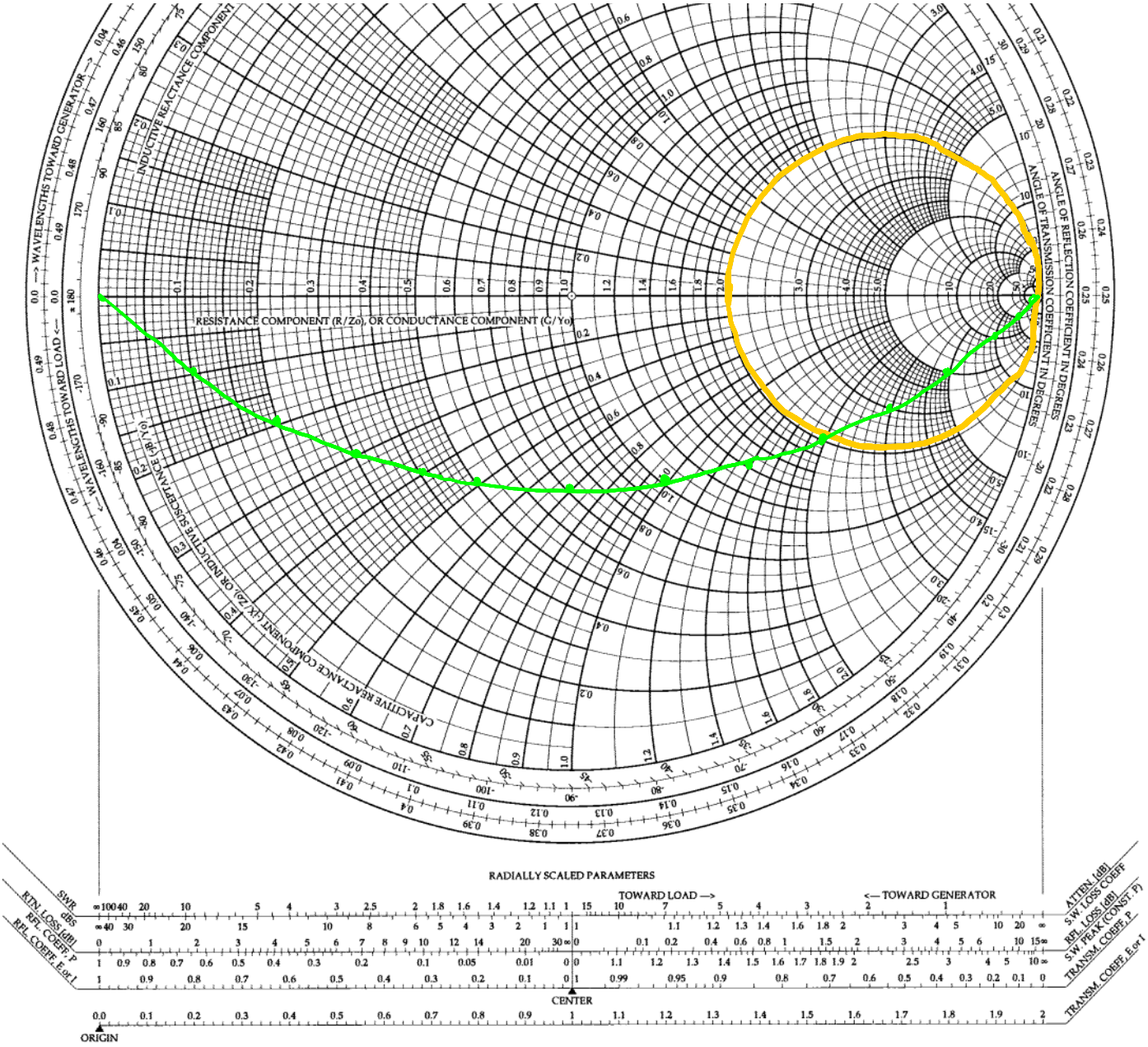
3c) $\underline{r}_Z = \frac{\underline{Z} - Z_L}{\underline{Z} + Z_L} = \ldots = \ominus \frac{\underline{Y} - Y_L}{\underline{Y} + Y_L}$

$Z = \frac{1}{Y}$ $\quad \underline{r}_Z = \ominus \underline{r}_Y$

3b)

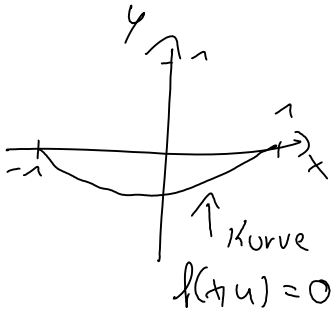


$Z_1 = (100 + j\,a)\,\Omega \cdot \frac{1}{Z_L} = 2\,\Omega + j\frac{a}{50\,\Omega}$



3 c) $\underline{z}_2 = (b - jb)\lambda \qquad -\infty < b < \infty$

$$\frac{\underline{z}_2}{z_L} = b' - jb' \qquad b' = \frac{b}{z_L}$$



$f(x,y) = 0$

$$\underline{r} = x + jy$$

$$= \frac{b' - jb' - 1}{b' - jb' + 1}$$

$x(b')$ und $y(b')$ mit

b' = Laufparameter

b' = Lauf parameter

$\mathrm{Re}\{\underline{r}\} \Rightarrow \quad x\,(b'+1) + b'y = b' \quad (1)$

$\mathrm{Im}\{\underline{r}\} \Rightarrow \quad b'y + y - b'x = -b' \quad (2)$

$\Big\} \; b' = \dfrac{y}{x-y-1}$

$\Rightarrow x^2 + (y-1)^2 = \left(\sqrt{2}^{-1}\right)^2$ Kreis: Mittelpunkt $(0,1)$

Radius $\sqrt{2}^{-1}$