Zoff := READPRN("offbox.txt") Zon := READPRN("onbox.txt")

Zoff =

	0	1	2
13	14.86	11.503	66.566
14	15.286	12.622	67.068
15	15.759	14.082	66.829
16	16.258	15.847	67.213
17	16.769	18.12	66.777
18	17.254	21.056	65.959
19	17.818	25.675	63.938
20	18.361	32.312	60.175
21	18.91	42.448	53.219
22	19.521	60.51	37.074
23	20.125	77.662	7.923
24	20.738	70.991	-28.364
25	21.378	50.327	-48.604
26	22.042	36.615	-59.509
27	22.746	28.3	-64.332

Zon =

	0	1	2
44	38.072	10.19	56.695
45	39.27	11.987	56.866
46	40.488	14.727	55.692
47	41.738	19.238	51.852
48	43.003	27.178	41.632
49	44.327	38.397	15.652
50	45.727	36.743	-23.678
51	47.141	25.162	-46.312
52	48.588	17.719	-55.473
53	50.081	13.193	-58.636
54	51.636	10.375	-58.284
55	53.245	8.62	-56.704
56	54.857	7.39	-54.888
57	56.595	6.358	-52.571
58	58.327	5.617	-48.829

$R_E := 2.8$ DC resistance $V_T := 1.56$ Test box volume

$N := 250$ Number of data points minus 1 $Z_p(x,y) := \frac{x \cdot y}{x + y}$ Parallel combinaton

From the Zoff array:

$f_S := 20.125$ $R_{ES} := 77.662 - R_E$ $R_{ES} = 74.862$ $R_1 := \sqrt{R_E \cdot (R_E + R_{ES})}$

$R_1 = 14.746$ $f_1 := 15.759$ $f_2 := 25.676$ $\sqrt{f_1 \cdot f_2} = 20.115$

$Q_{MS} := \frac{f_S}{f_2 - f_1} \cdot \sqrt{\frac{R_E + R_{ES}}{R_E}}$ $Q_{MS} = 10.688$ $Q_{ES} := \frac{R_E}{R_{ES}} \cdot Q_{MS}$ $Q_{ES} = 0.4$

$Q_{TS} := \frac{R_E}{R_E + R_{ES}} \cdot Q_{MS}$ $Q_{TS} = 0.385$

$$n_e := \frac{2}{\pi}\cdot\arg\left(Zoff_{250,1}\cdot\cos\left(Zoff_{250,2}\cdot\frac{\pi}{180}\right) - R_E + j\cdot Zoff_{250,1}\cdot\sin\left(Zoff_{250,2}\cdot\frac{\pi}{180}\right)\right) \qquad n_e = 0.677$$

$$L_e := \frac{\sqrt{\left(Zoff_{250,1}\cdot\cos\left(Zoff_{250,2}\cdot\frac{\pi}{180}\right) - R_E\right)^2 + \left(Zoff_{250,1}\cdot\sin\left(Zoff_{250,2}\cdot\frac{\pi}{180}\right)\right)^2}}{\left(2\cdot\pi\cdot Zoff_{250,0}\right)^{n_e}} \qquad L_e = 0.04$$

$n := 0 .. N \qquad f_n := 10\cdot\left(\frac{20000}{10}\right)^{\frac{n}{N}}$ Frequency range variable for calculating Zvc(f)

$L_E := 0.012$ "Tweaked" value of parallel lossless inductor in Allen Robinson's model

$$Zvc(f) := R_E + Z_p\left[j\cdot 2\cdot\pi\cdot f\cdot L_E, L_e\cdot(j\cdot 2\cdot\pi\cdot f)^{n_e}\right] + R_{ES}\cdot\frac{\frac{1}{Q_{MS}}\cdot\left(\frac{j\cdot f}{f_S}\right)}{1 - \left(\frac{f}{f_S}\right)^2 + \frac{1}{Q_{MS}}\cdot\left(\frac{j\cdot f}{f_S}\right)}$$

From the Zon array:

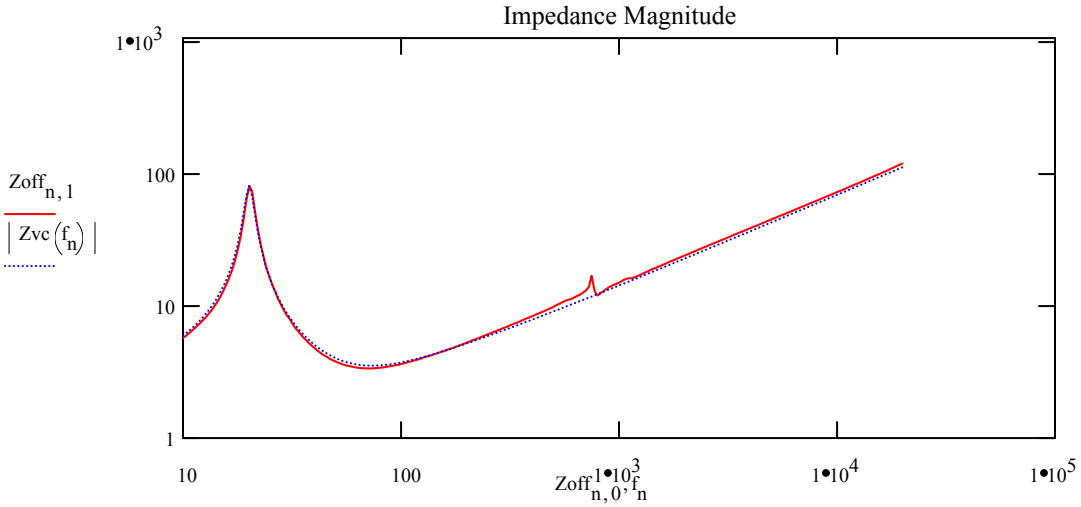
$f_{CT} := 44.327 \qquad R_{ECT} := 38.397 - R_E \quad R_{ECT} = 35.597 \qquad R_1 := \sqrt{R_E\cdot\left(R_E + R_{ECT}\right)}$

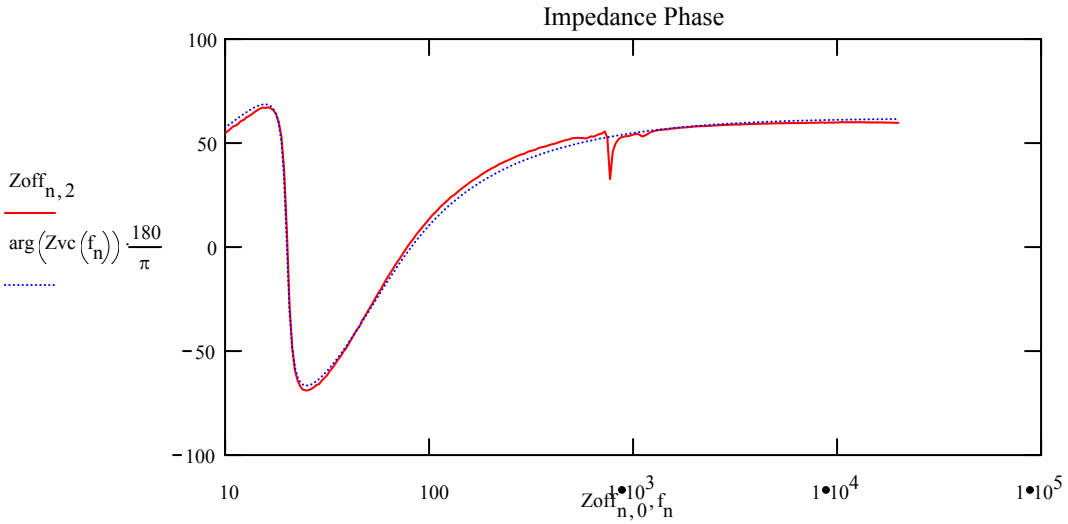
$R_1 = 10.369 \qquad f_{1T} := 38.072 \qquad f_{2T} := 51.636 \qquad \sqrt{f_{1T}\cdot f_{2T}} = 44.338$

$$Q_{MCT} := \frac{f_{CT}}{f_{2T} - f_{1T}}\cdot\sqrt{\frac{R_E + R_{ECT}}{R_E}} \qquad Q_{MCT} = 12.102$$

$$Q_{ECT} := \frac{R_E}{R_{ECT}}\cdot Q_{MCT} \qquad Q_{ECT} = 0.952 \qquad Q_{TCT} := \frac{R_E}{R_E + R_{ECT}}\cdot Q_{MCT} \qquad Q_{TCT} = 0.882$$

$$V_{AS} := V_T\cdot\left(\frac{f_{CT}}{f_S}\cdot\frac{Q_{ECT}}{Q_{ES}} - 1\right) \qquad V_{AS} = 6.622$$


Impedance Magnitude
Zoff n, 1
| Zvc (f n) |
1•10^3
100
10
1
10
100
1•10^4
1•10^5
Zoff n, 0, f n


Impedance Phase
Zoff n, 2
arg (Zvc (f n)) · 180 / π
100
50
0
−50
−100
10
100
1•10^3
1•10^4
1•10^5
Zoff n, 0, f n