Scilab Manual for Radio Frequency Circuit Design by Prof Nandini Ammangi Electronics Engineering VESIT[1]

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Experiment: 1

To plot frequency response of high frequency resistor

Scilab code Solution 1.1 To plot frequency response of high frequency resistor

```
1 //To plot the frequency response of high frequency
     Resistor
2 //Scilab 5.4.1;64 bit(windows 8)
3 f=10^4:10^5:10^10;
4 w=2*%pi.*f;
5 mu0=4*%pi*10^-7;
6 l=2*2.5*10^-2;
7 a=2.032*10^-4;
8 temp=log(2*l/a)/log(%e);
9 lex=mu0*l*(temp-1)/(2*%pi); //external inductance
10 r=2*10^3;                  // resistance
11 c=5*10^-12;                //capacitance
12 z=w*lex*%i+1 ./(w*c*%i+1/r); //impedance
13 plot2d("gll",f,abs(z));
```

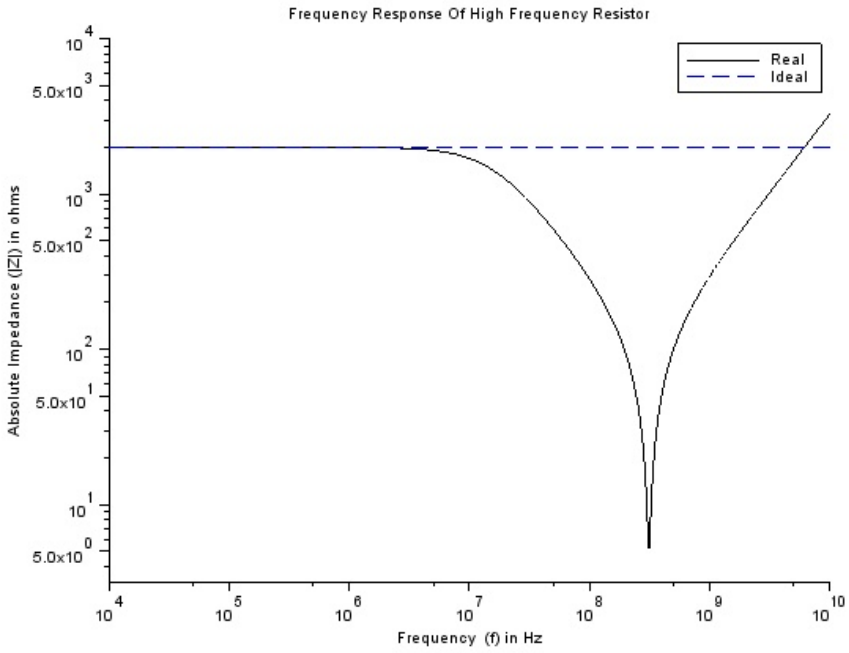

Figure 1.1: To plot frequency response of high frequency resistor

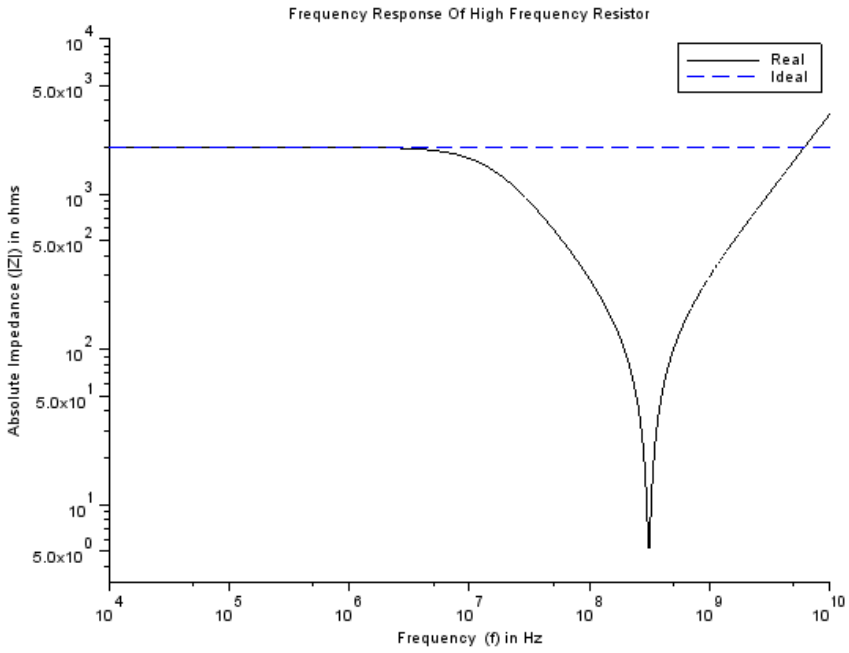

Figure 1.2: To plot frequency response of high frequency resistor

```
14 plot(f,r,"--");
15 title("Frequency Response Of High Frequency Resistor
      ");
16 xlabel('Frequency  (f) in Hz');
17 ylabel('Absolute Impedance (|Z|) in ohms');
18 legend(["Real ";"Ideal"]);
```

Experiment: 2

To plot frequency response of high frequency capacitor

Scilab code Solution 2.1 To plot frequency response of high frequency capacitor

```
1 //To plot frequency response of hgh frequency
     Capacitor
2 //Scilab 5.4.1;64 bit(windows 8)
3 f=10^6:10^7:10^10;
4 rs=(4.8*10^-6).*sqrt(f);
5 re=(33.9*10^12) ./f;
6 mu0=4*%pi*10^-7;
7 c=47*10^-12;
8 w=2*%pi.*f;
9 l=2*1.25*10^-2;
10 a=2.032*10^-4;
11 temp=log(2*l/a)/log(%e);
12 lex=mu0*l*(temp-1)/(2*%pi);          //external
     inductance
```

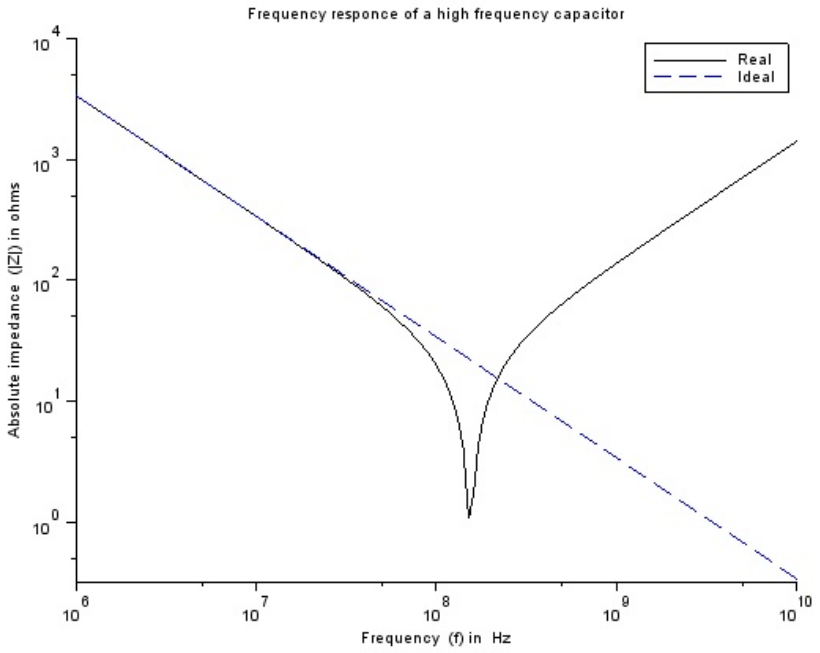

Figure 2.1: To plot frequency response of high frequency capacitor

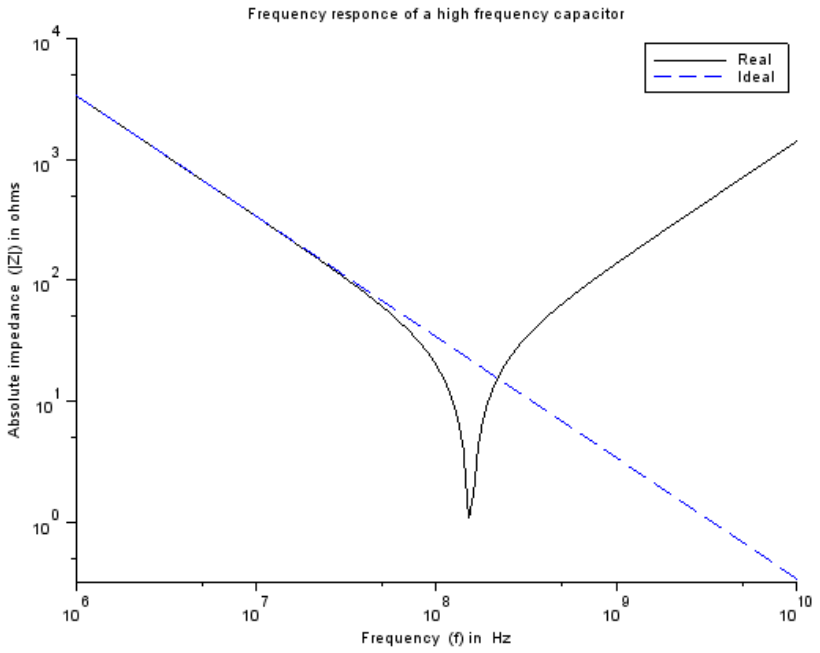

Figure 2.2: To plot frequency response of high frequency capacitor

```
13 z=1 ./(1 ./re +w*c*%i)+rs+w.*lex*%i; // impedance of
       frequency dependent capacitor
14 zideal=1 ./(w*c*%i);     //impedance of an ideal
      capacitor
15 plot2d("gll",f,abs(z));
16 plot(f,abs(zideal),"--");
17 title("Frequency responce of a high frequency
      capacitor");
18 xlabel('Frequency (f) in Hz');
19 ylabel('Absolute impedance (|Z|) in ohms');
20 legend(["Real ";"Ideal"]);
```

Experiment: 3

To plot frequency response of high frequency inductor

Scilab code Solution 3.1 To plot frequency response of high frequency inductor

```
1 //To plot frequency response of high frequency
     Inductor
2 //Scilab 5.4.1;64 bit(windows 8)
3 f=10^7:10^8:10^10;
4 w=2*%pi.*f;
5 N=3.5;        //number of turns
6 rad=0.05*0.0254;
7 len=0.05*0.0254;       //length of wire
8 a=(5*0.0254*10^-3)/2;
9 u0=4*%pi*10^-7;
10 sig_cu=64.516*10^6;
11 e0=8.854*10^-12;
12 l=(%pi*rad^2*u0*(N^2))/len;
13 c=(e0*4*%pi*rad*(N^2)*a)/len;
```

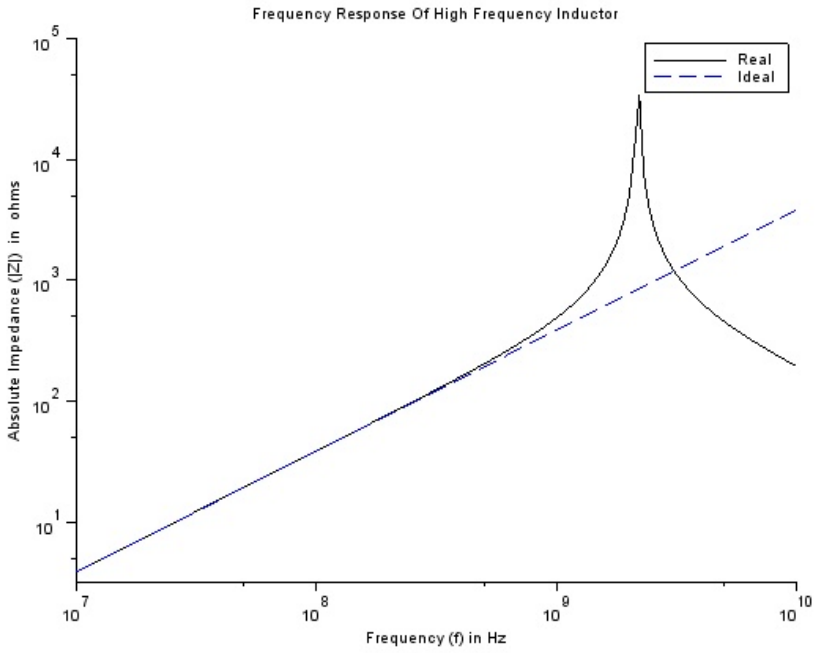

Figure 3.1: To plot frequency response of high frequency inductor

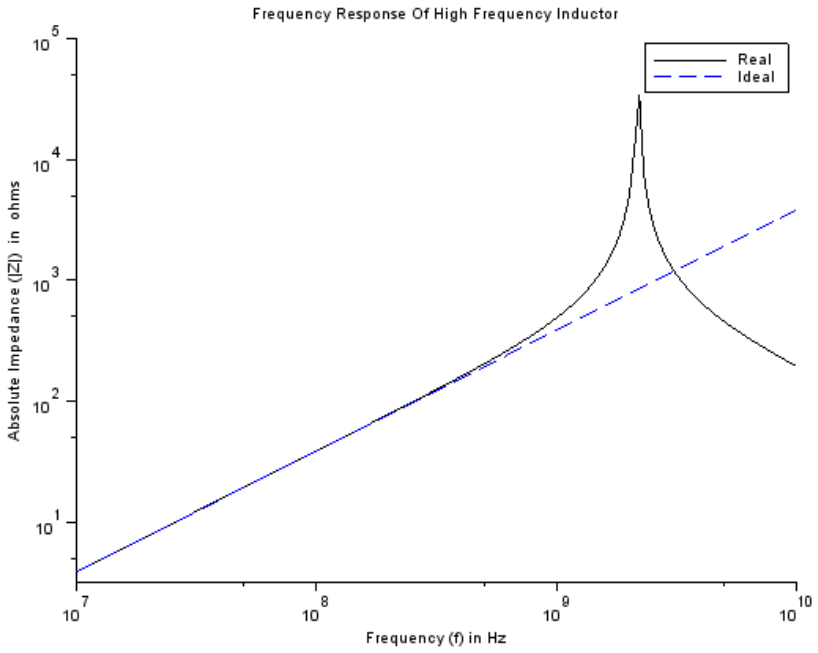

Figure 3.2: To plot frequency response of high frequency inductor

```
14 r=(2*rad*N)/(sig_cu*(a^2));
15 z=1 ./((1 ./(r+w*%i*l))+w*%i*c); //impedance
16 zideal=w*%i.*l;                  //impedance of an
      ideal inductor
17 plot2d("gll",f,abs(z));
18 plot(f,abs(zideal),"--");
19 title("Frequency Response Of High Frequency Inductor
      ");
20 xlabel('Frequency (f) in Hz');
21 ylabel('Absolute Impedance (|Z|) in ohms');
22 legend(["Real ";"Ideal"]);
```

Experiment: 4

To plot SWR circle for an impedance

Scilab code Solution 4.1 To plot SWR circle for an impedance

```
1 //To plot SWR circle for the impedance
2 //Scilab 5.4.1;64 bit(windows 8)
3 Z0=50; //define 50 Ohm characteristic impedance
4 Z=[50 48.5 75+%i*25 10-%i*5]; //define impedances
     for this example
5 Gamma=(Z-Z0)./(Z+Z0) //compute corresponding
     reflection coefficients
6 SWR=(1+abs(Gamma))./(1-abs(Gamma)); //find the SWRs
7 a=0:0.01:2*%pi;
8 for n=1:length(Z)
9
10 plot(abs(Gamma(n))*cos(a),abs(Gamma(n))*sin(a),'b','
     linewidth',2);
11 plot(real(Gamma(n)), imag(Gamma(n)),'ro');
12 end;
```

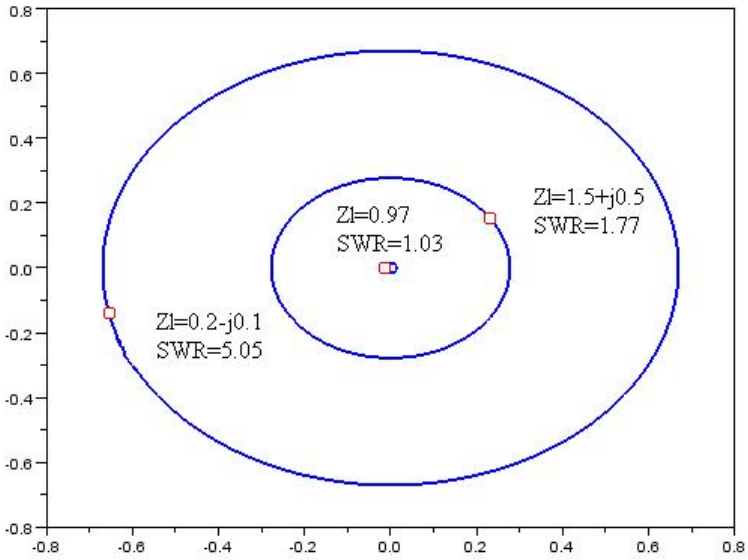

Figure 4.1: To plot SWR circle for an impedance

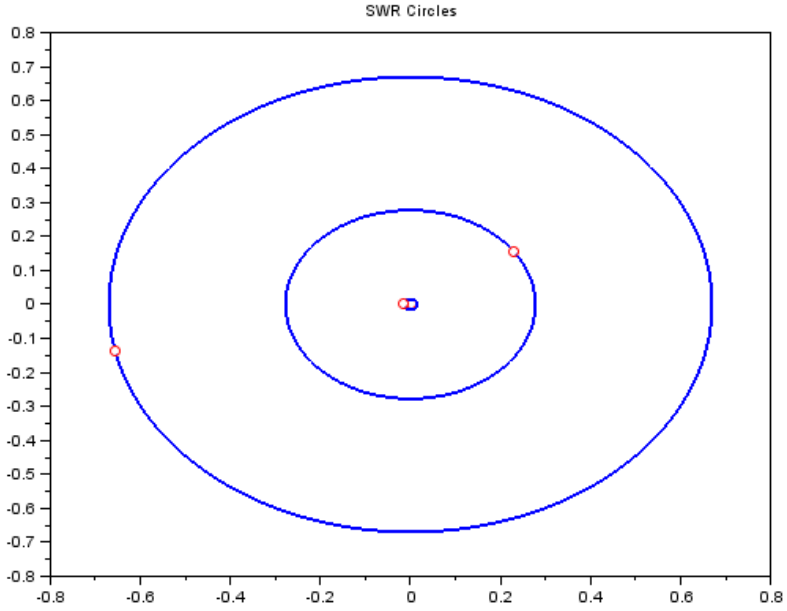

Figure 4.2: To plot SWR circle for an impedance

```
13
14 for n=1:length(Z)
15     if n~=1
16     end;
17 end;
18 title("SWR Circles");
```

Experiment: 5

To plot efficiency of different types of amplifiers

Scilab code Solution 5.1 To plot efficiency of different types of amplifiers

```
1 //To plot efficiency of different types of
     amplifiers
2 //Scilab 5.4.1;64 bit(windows 8)
3 theta=(1:1:360)/180*%pi; //define conduction angle
4
5 //compute efficiency
6 nu=-1/2*(theta-sin(theta))./(theta.*cos(theta/2)-2*
     sin(theta/2));
7
8 plot(theta/%pi*180,nu*100,'r','linewidth',2);
9 set(gca(),"auto_clear","off");
10 plot([0 180],[%pi/4*100 %pi/4*100],'b:');
11 plot([180 180],[0 %pi/4*100],'b:');
12 plot(180,%pi/4*100,'bo');
13 plot(360,50,'bo');
```

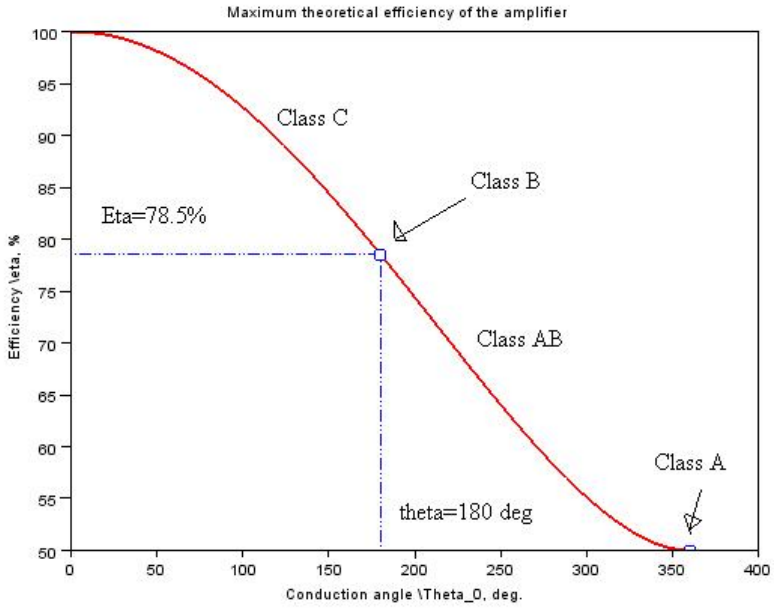

Figure 5.1: To plot efficiency of different types of amplifiers

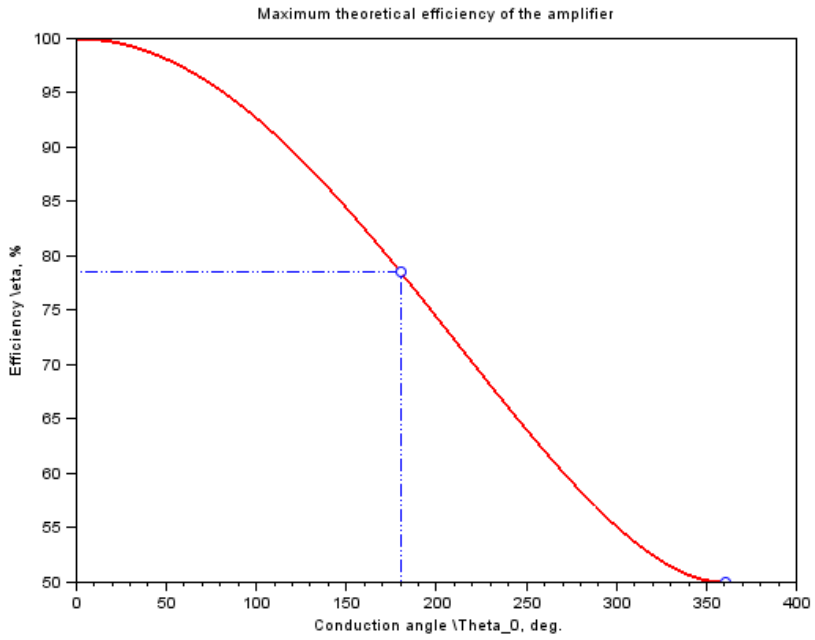

Figure 5.2: To plot efficiency of different types of amplifiers

```
14 mtlb_axis([0 360 50 100]);
15 title('Maximum theoretical efficiency of the
      amplifier');
16 xlabel('Conduction angle \Theta_0, deg.');
17 ylabel('Efficiency \eta, %');
```