% "RF impedance response of capacitor"

%

close all; % close all opened graphs

figure; % open new graph

sigma\_Cu=64.516e6; % define material conductivity

mu=4\*pi\*1e-7; % define permeability of free space

% define constants for this example

C=47e-12; % capacitance in Farads

loss=1e-4; % series loss tangent

l=0.0125; % length of leads in meters

a=2.032e-4; % radius of leads in meters (AWG 26)

% define frequency range

f\_min=100e6; % lower frequency limit

f\_max=100e9; % upper frequency limit

N=300; % number of points in the graph

f=f\_min\*((f\_max/f\_min).^((0:N)/N)); % compute frequency points on log scale

w=2\*pi\*f;

L=2\*l/(4\*pi\*a)\*sqrt(mu./(pi\*sigma\_Cu\*f)); % lead inductance

Rs=2\*l/(2\*a)\*sqrt(mu\*f/(pi\*sigma\_Cu)); % lead resistance

Re=1./(w\*C\*loss); % leackage resistance

Z=Rs+j\*w.\*2.\*L+1./(j\*w\*C+1./Re); % capacitor impedance

Z\_ideal=1./(j\*w\*C); % ideal capacitor impedance

loglog(f,abs(Z),f,abs(Z\_ideal));

title('Impedance of a capacitor as function of frequency');

xlabel('Frequency {\itf}, Hz');

ylabel('Impedance |Z|, {\Omega}');