% "RF impedance response of wire-wound inductor"

%

clear all; % clear all variables

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

epsilon=8.85e-12; % define permittivity of free space

% define constants for this example

a=63.5e-6; % radius of wire

r=1.27e-3; % radius of coil

l=1.27e-3; % length of coil

NN=3.5; % number of turns

% compute parameters of the equivalent circuit

L=pi\*r^2\*mu\*NN^2/l; % inductance of the computed coil

% using the formula for a solenoid

C=4\*pi\*epsilon\*r\*a\*NN^2/l; % capacitance between turns

R=2\*pi\*r\*NN/(sigma\_Cu\*pi\*a^2); % resistance of the wire

% 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;

Z=1./(j\*w\*C+1./(R+j\*w\*L)); % impedance of the coil

Z\_ideal=j\*w\*L; % ideal inductor 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}');

legend('wire-wound inductor', 'ideal inductor');