Projeto - Eletromagnetismo e Ondulatória

1- Modelando Antena Emissora

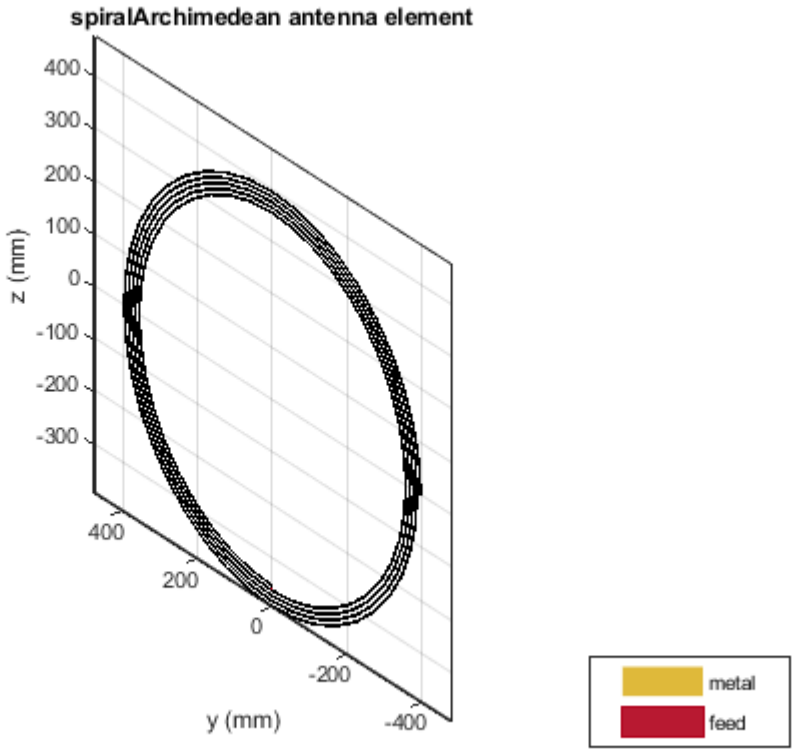
```
ant = spiralArchimedean('Turns', 5) % entre 3 e 6 voltas
```

```
ant =
  spiralArchimedean with properties:

            NumArms: 2
              Turns: 5
        InnerRadius: 5.0000e-04
        OuterRadius: 0.0398
    WindingDirection: 'CCW'
               Tilt: 0
           TiltAxis: [1 0 0]
               Load: [1×1 lumpedElement]
```

```
ant.NumArms = 1; % número de braços (ramos)  = 1
ant.Tilt = 90; % Inclinação da antena plano 3D
ant.TiltAxis = "Y"
```

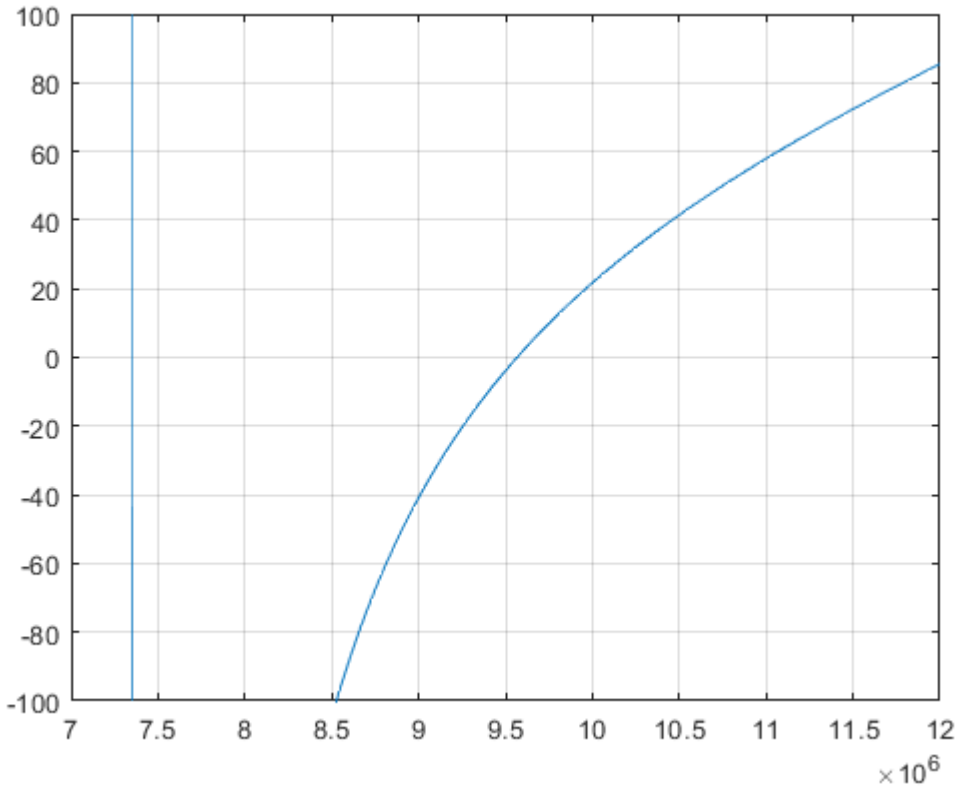
```
ant =
  spiralArchimedean with properties:

            NumArms: 1
              Turns: 5
        InnerRadius: 5.0000e-04
        OuterRadius: 0.0398
    WindingDirection: 'CCW'
               Tilt: 90
           TiltAxis: 'Y'
               Load: [1×1 lumpedElement]
```

```
ant.OuterRadius = 40e-2;
ant.InnerRadius = 35e-2;
show(ant)
```



2- Impedância da Antena

```
f = linspace(6e6, 12e6, 100);

impedancia = impedance(ant,f);
imaginario = imag(impedancia);
plot(f,imaginario)
ylim([-100, 100])
grid
```




```
% Impedância nula = f = 9545450
% Wc = 4437190
```

3- Modelando Antena Receptora

```
ant2 = spiralArchimedean('Turns', 5) % entre 3 e 6 voltas
```

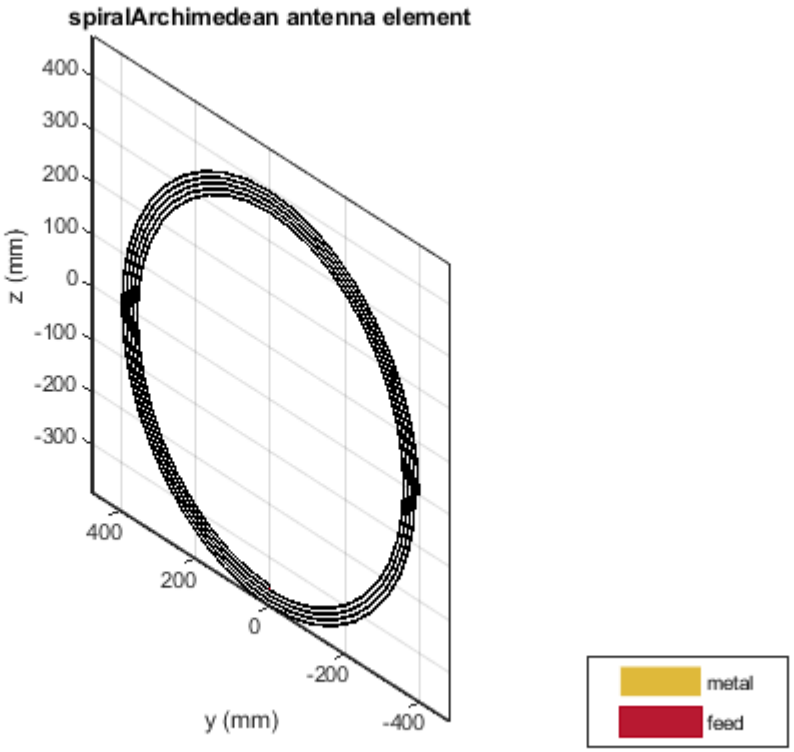
```
ant2 =
  spiralArchimedean with properties:

            NumArms: 2
              Turns: 5
        InnerRadius: 5.0000e-04
        OuterRadius: 0.0398
    WindingDirection: 'CCW'
               Tilt: 0
           TiltAxis: [1 0 0]
               Load: [1×1 lumpedElement]
```

```
ant2.NumArms = 1; % número de braços (ramos)  = 1
ant2.Tilt = 90; % Inclinação da antena plano 3D
ant2.TiltAxis = "Y"
```

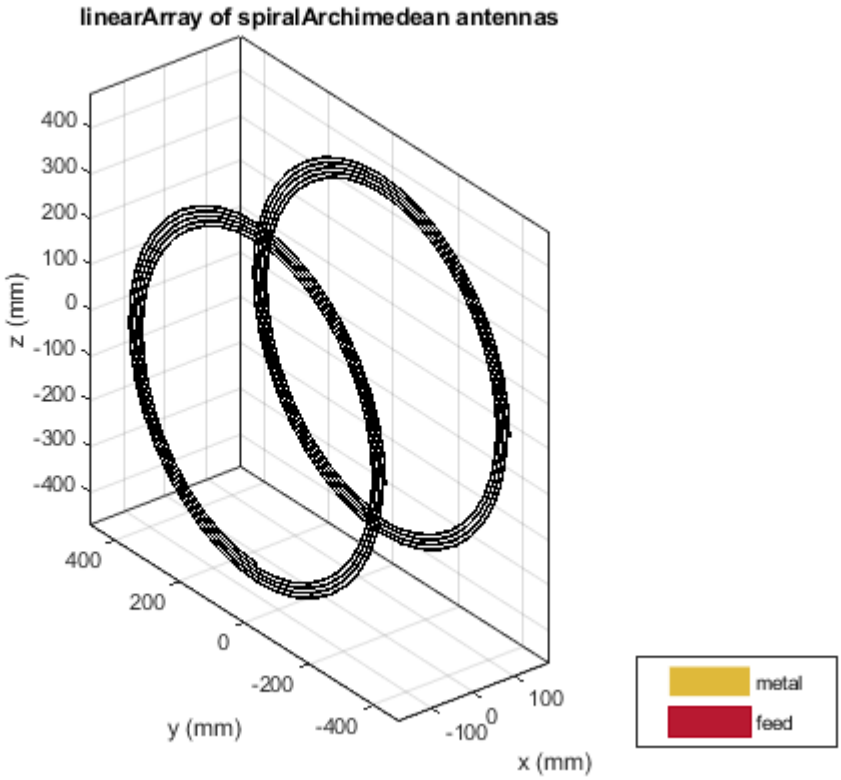
```
ant2 =
  spiralArchimedean with properties:

            NumArms: 1
              Turns: 5
        InnerRadius: 5.0000e-04
        OuterRadius: 0.0398
```

```
    WindingDirection: 'CCW'
                Tilt: 90
            TiltAxis: 'Y'
                Load: [1×1 lumpedElement]
```

```
ant2.OuterRadius = 40e-2;
ant2.InnerRadius = 35e-2;
show(ant2)
```




```
% Element Space
la = linearArray;
la.Element = [ant, ant2];
la.ElementSpacing = .3;
show(la);
```



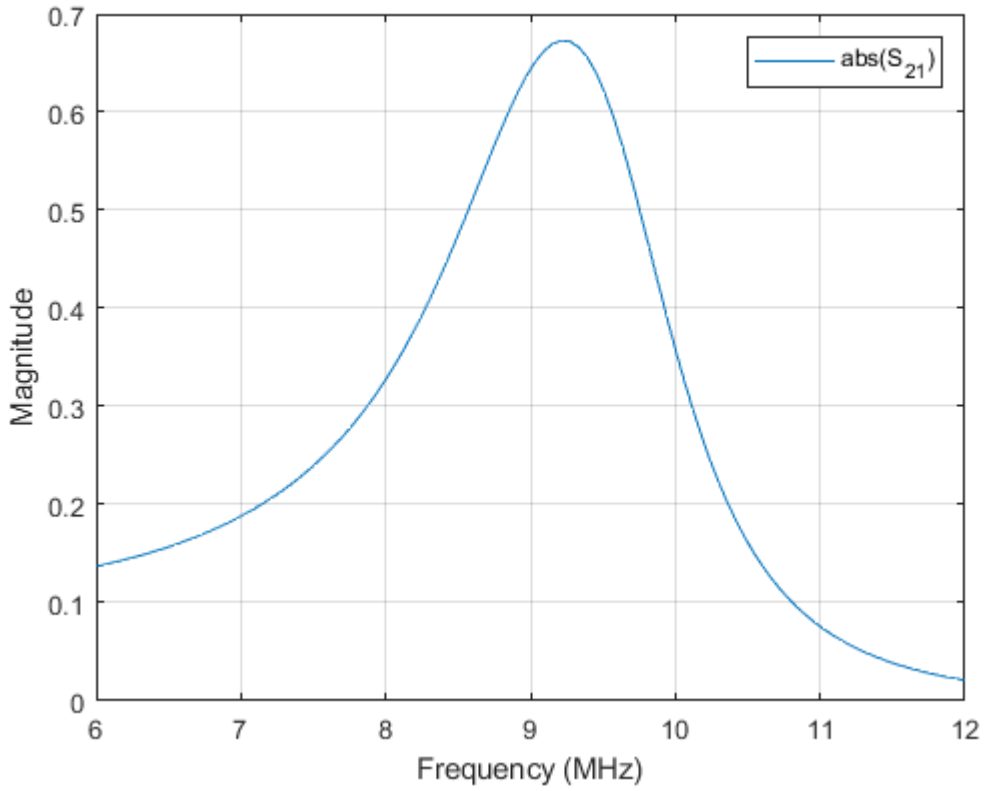
4- Simulando o Acoplamento

```
sd = sparameters(la, f)
```

```
sd =
  sparameters: S-parameters object

       NumPorts: 2
    Frequencies: [100×1 double]
     Parameters: [2×2×100 double]
      Impedance: 50

  rfparam(obj,i,j) returns S-parameter Sij
```

5- Visualizando os Ganhos

```
rfplot(sd,2,1,'abs')
```




```
gains = abs(rfparam(sd,2,1));
max_gain = abs(max(gains))
```

```
max_gain = 0.6731
```

Essa frequência é especial pois é a de ressonância (amplifica o ganho). A relação é a de que, a maior magnitude é aquela com frequência semelhante a de ressonância do gráfico de impedâncias, ou seja, o ponto em que a parte imaginária da impedância é zero.

6- Criando array de ganhos

```
% ganho = abs(rfparam(sd,2,1)) % exemplo de vetor ganho
spacing = linspace(5e-2, 1, 20)'; % Variando para as diferentes distâncias
disp(length(spacing))
```

```
    20
```

```
gains = zeros(length(spacing), length(f))
```

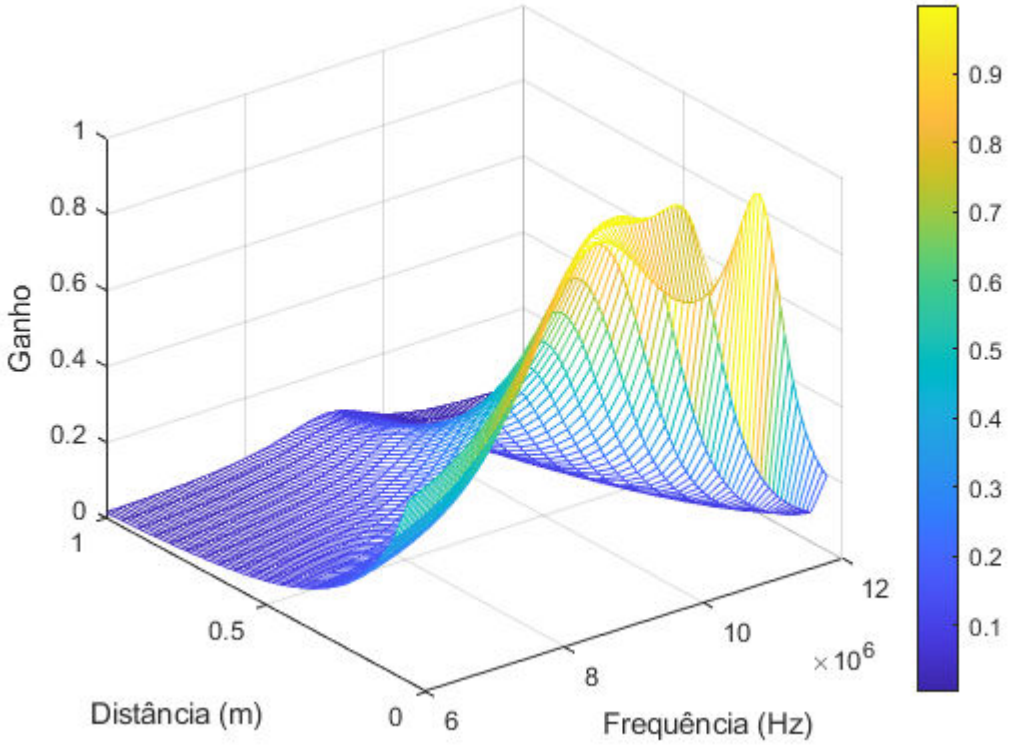
```
gains = 20×100
     0     0     0     0     0     0     0     0     0     0     0     0     0 ···
     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0
     0     0     0     0     0     0     0     0     0     0     0     0     0
```

```
     0     0     0     0     0     0     0     0     0     0     0     0     0
     ⋮
```

```
for i=1:length(spacing)
    la.ElementSpacing = spacing(i);
    sd = sparameters(la, f);
    gains(i,:) = abs(rfparam(sd,2,1));
end
```

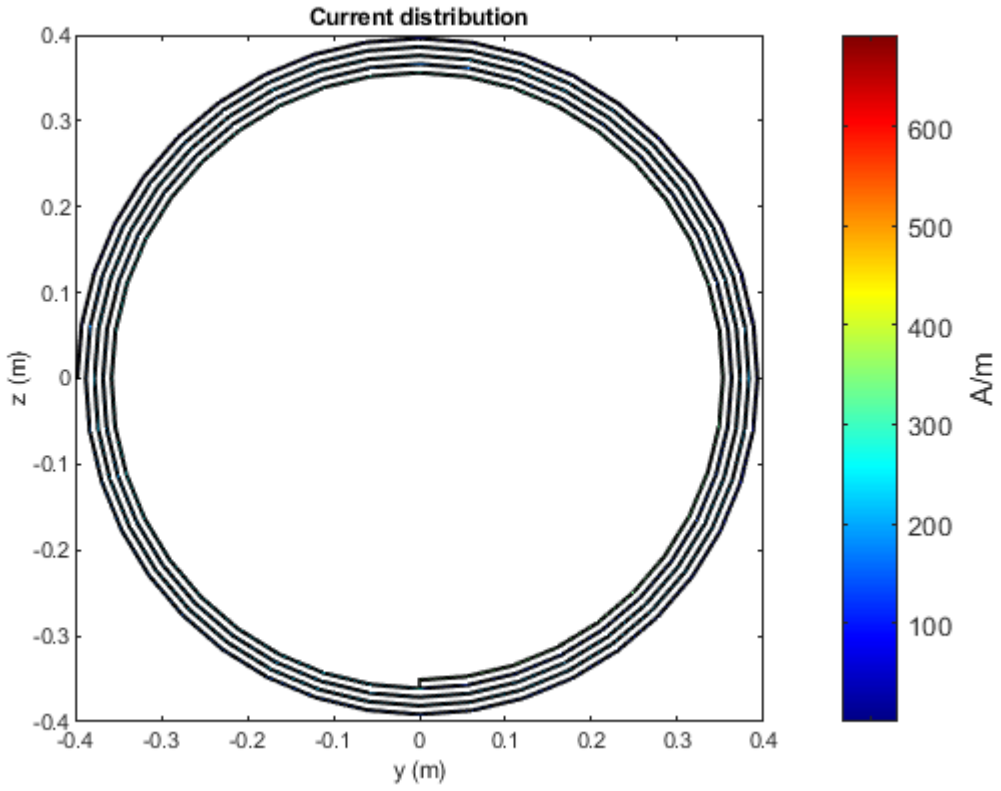
Gráfico

```
mesh(f, spacing, gains)
colorbar
xlabel('Frequência (Hz)')
ylabel('Distância (m)')
zlabel('Ganho')
```



7- Corrente Ressonante

```
current(ant2,9545450)
```


Current distribution
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
z (m)
-0.4
-0.3
-0.2
-0.1
0
0.1
0.2
0.3
0.4
y (m)
600
500
400
300
200
100
A/m