

Diagramme de rayonnement

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Feb 20, 2020

1 Simulation Python

La fonction caractéristique de rayonnement en champ est alors :

$$f(\theta) = \left| \frac{E_M(\theta)}{E_M(\theta = \pi/2)} \right| = \left| \frac{\cos\left(2\pi \frac{l}{\lambda} \cos \theta\right) - \cos\left(2\pi \frac{l}{\lambda}\right)}{\sin \theta \left(1 - \cos\left(2\pi \frac{l}{\lambda}\right)\right)} \right| \text{ (à calculer en TD)}$$

En particulier,

- cas du dipôle demi-onde : $2l = \lambda/2$, on a :

$$f(\theta) = \left| \frac{\cos\left(\frac{\pi}{2} \cos \theta\right)}{\sin \theta} \right|$$

- cas du dipôle onde entière : $2l = \lambda$, on a :

$$f(\theta) = \frac{1}{2} \left| \frac{\cos(\pi \cos \theta) + 1}{\sin \theta} \right| = \left| \frac{\cos^2\left(\frac{\pi}{2} \cos \theta\right)}{\sin \theta} \right|$$

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## NOM DU PROGRAMME: DipRadiation.py
## IMPORTATION
import numpy as np
import matplotlib.pyplot as plt
import mpl_toolkits.mplot3d.axes3d as axes3d
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def rho(theta, rapport = 0.7):
    u = 2*rapport*np.pi
    F = (np.cos(u*np.cos(theta)) - np.cos(u))/np.sin(theta)
    G = F * F
    return G/G.max()

plt.figure()
ax = plt.subplot(111, polar=True)
plt.title("Rayonnement d'une antenne dipolaire de longueur L")
ax.set_theta_zero_location('N')
ax.set_theta_direction(-1)

ax.grid(True)
theta = np.linspace(0.01, 2*np.pi, 500)

for rapport in [0.1, 0.5, 1.0, 1.5]:
    ax.plot(theta, rho(theta, rapport), label=r"$L/\lambda = %.1f$" % rapport)
plt.legend(loc='lower right')
plt.tight_layout()
plt.savefig("dipole.png"); plt.savefig("dipole.pdf")
plt.show()

## Dipôle 3D
theta = np.linspace(0.01, np.pi, 400)
phi = np.linspace(0.01, 2*np.pi, 400)
THETA, PHI = np.meshgrid(theta, phi)
#
def sph2cart(azimuth, elevation, r):
    x = r * np.sin(elevation) * np.cos(azimuth)
    y = r * np.sin(elevation) * np.sin(azimuth)
    z = r * np.cos(elevation)
    return x, y, z

rapport = 0.5
X, Y, Z = sph2cart(PHI, THETA, rho(THETA, rapport = rapport))
# Plot
import matplotlib.colors as mcolors
fig = plt.figure()
ax = fig.add_subplot(1, 1, 1, projection='3d')
ax._axis3don = False # hide x, y, z axis
cmap = plt.get_cmap('gnuplot')
norm = mcolors.Normalize(vmin=Z.min(), vmax=Z.max())
plot = ax.plot_surface(
    X, Y, Z, rstride=8, cstride=8,
    facecolors=cmap(norm(Z)), antialiased=True, alpha=0.5)

plt.title("Diagramme de rayonnement: "+r"$L/\lambda = %.1f$" % rapport)
plt.tight_layout()
plt.savefig("dipole3D.png"); plt.savefig("dipole3D.pdf")

```

Rayonnement d'une antenne dipolaire de longueur L

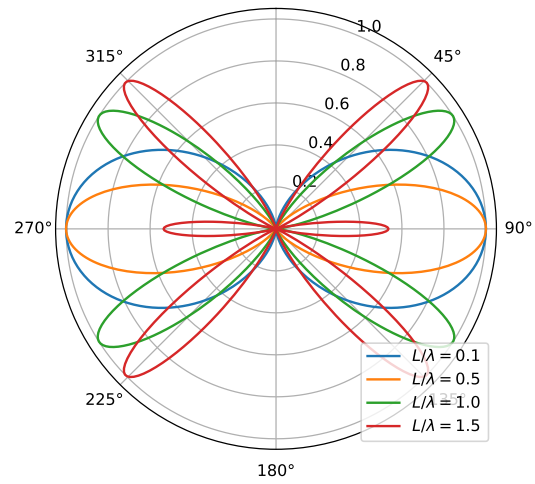


Diagramme de rayonnement: $L/\lambda = 0.5$

