Arrays

$$\vec{E}_{dipolo} = j\eta \frac{e^{-jkr}}{2\pi r} I \frac{\cos\left(\frac{\pi}{2}\cos(\theta)\right)}{\sin\theta}\hat{\theta}, \ \eta = 120\pi$$

$$Z_{dip}^{\lambda/2} = 73 + j42 \ \Omega$$

$$|FA(\psi)| = \left|\frac{\sin(N\frac{\psi}{2})}{\sin(\frac{\psi}{2})}\right|$$

$$D_{max} = \frac{S_{max}}{P_{rad}}4\pi r^2 = \frac{|E_{max}|^2}{P_{rad}}\frac{4\pi r^2}{\eta} = \frac{120}{R_{in-dip}^{tot}}N^2$$

$$D_{boradside} \simeq 2N\frac{d}{\lambda}$$

$$D_{endfire} \simeq 4N\frac{d}{\lambda}$$

Margen visible: $[-kd + \alpha, \ kd + \alpha]$

$$\begin{cases} k_x = k\sin(\theta)\cos(\varphi) \\ k_y = k\sin(\theta)\sin(\varphi) \\ k_z = k\cos(\theta) \end{cases}$$

Nulos del FA: $\frac{2\pi}{N}, \frac{4\pi}{N}, \frac{6\pi}{N}, \ldots, 2\pi\frac{N-1}{N}$

$$NLPS = 20\log_{10}\left(\frac{N}{|FA(\frac{3\pi}{N})|}\right) = 20\log_{10}\left(N\sin\left(\frac{3\pi}{2N}\right)\right) dB$$

$$RDA = 20\log_{10}\left(\frac{|FA(0)|}{|FA(-2kd)|}\right) dB$$

Acoplamientos mutuos: $\begin{cases} V_i = Z_{i1}I_1 + Z_{i2}I_2 + \cdots + Z_{ij}I_j \\ Z_i = \frac{V_i}{I_i} = Z_{i1}\frac{I_1}{I_i} + Z_{i2}\frac{I_2}{I_i} + \cdots + Z_{ij}\frac{I_j}{I_i} \end{cases}$

Bocinas

$$\vec{E}_{apertura} = E_0\cos\left(\frac{\pi}{a_g}x\right)\hat{y}$$

$$s = \frac{b^2}{8\lambda L_E}, \ s_{opt} = \frac{1}{4}$$

$$t = \frac{a^2}{8\lambda L_H}, \ t_{opt} = \frac{3}{8}$$

Error de fase: $\begin{cases} \text{Plano E} \to 2\pi s \\ \text{Plano H} \to 2\pi t \end{cases}$

$$b_{opt} = \sqrt{2\lambda L_E}$$

$$a_{opt} = \sqrt{3\lambda L_H}$$

$$D_{pir} = \frac{4\pi}{\lambda^2}A_{eff} = \frac{4\pi}{\lambda^2}A_{geom}\eta_{il} = \frac{4\pi}{\lambda^2}a\,b\,\eta_{il_x}\eta_{il_y}$$

$$\eta_{il,\,pir}^{opt} \simeq 0.5188$$

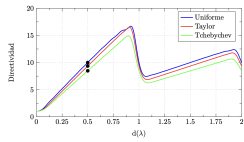$$\eta_{il,\,H}^{opt} = \eta_{il,\,E}^{opt} \simeq 0.6485$$

Reflectores

$$R = f + (f - R\cos(\alpha)) \Rightarrow R = \frac{2f}{1+\cos(\alpha)} = \frac{f}{\cos^2\left(\frac{\alpha}{2}\right)}$$

$$\rho = R\sin(\alpha) = 2f\tan\left(\frac{\alpha}{2}\right)$$
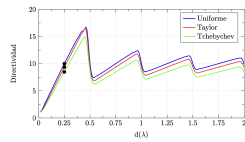
$$\tau_c = 40\log_{10}\left(\cos\left(\frac{\beta}{2}\right)\right) dB$$

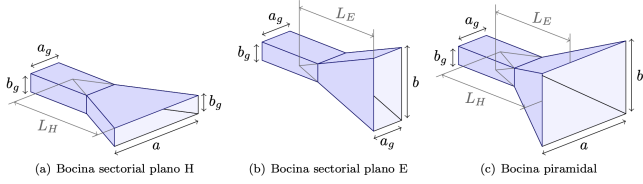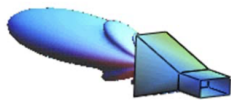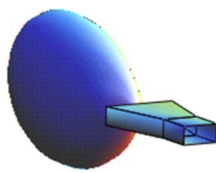$$\frac{f}{D} = \frac{1}{4\tan\left(\frac{\beta}{2}\right)}$$

Broadside N = 10

Directividad / d(λ)
Uniforme
Taylor
Tchebychev

Endfire N = 10

Directividad / d(λ)
Uniforme
Taylor
Tchebychev

Reflector Parabolico

R
R
ρ
α
f
$Foco$
$Directriz$

Bocinas

a_g
b_g
b_g
L_H

(a) Bocina sectorial plano H

a_g
L_E
b_g
b
L_H
a_g

(b) Bocina sectorial plano E

a_g
L_E
b_g
b
L_H
a

(c) Bocina piramidal

Bocina Plano E

Bocina Plano H

Reflector plano E

Amplitud normalizada (dB)
$\frac{b}{\lambda}\,\mathrm{sen}\theta$

$s = 0$
$s = \frac{1}{8}$
$s = \frac{1}{4}$
$s = \frac{3}{8}$
$s = \frac{1}{2}$
$s = 1$

Reflector plano H

Amplitud normalizada (dB)
$\frac{a}{\lambda}\,\mathrm{sen}\theta$

$t = 0$
$t = \frac{1}{8}$
$t = \frac{1}{4}$
$t = \frac{3}{8}$
$t = \frac{1}{2}$
$t = 1$

Directividad Bocina Plano E

$\frac{\lambda}{r_1}D_E$
$b(\lambda)$

$L_E = 6\lambda$
$L_E = 10\lambda$
$L_E = 15\lambda$
$L_E = 20\lambda$
$L_E = 30\lambda$
$L_E = 50\lambda$

Directividad Bocina Plano H

$\frac{\lambda}{r_2}D_H$
$a(\lambda)$

$L_H = 6\lambda$
$L_H = 10\lambda$
$L_H = 15\lambda$
$L_H = 20\lambda$
$L_H = 30\lambda$
$L_H = 50\lambda$

Dipolo $\frac{\lambda}{2}$

$\vec{E} = E_\theta\,\hat{\theta}$
$\hat{r}$

Espira elemental $(a \ll \lambda)$

$\vec{E} = E_\phi\,\hat{\phi}$
$\hat{r}$
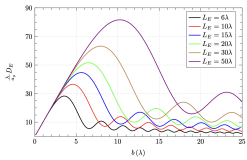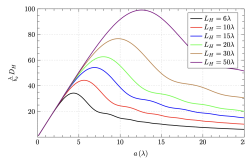
z_{12} de dipolos paralelos de H = λ/4
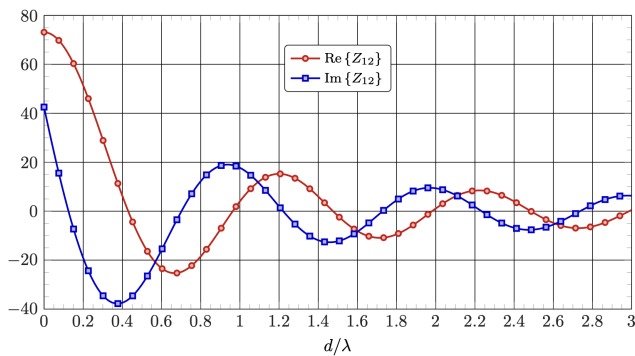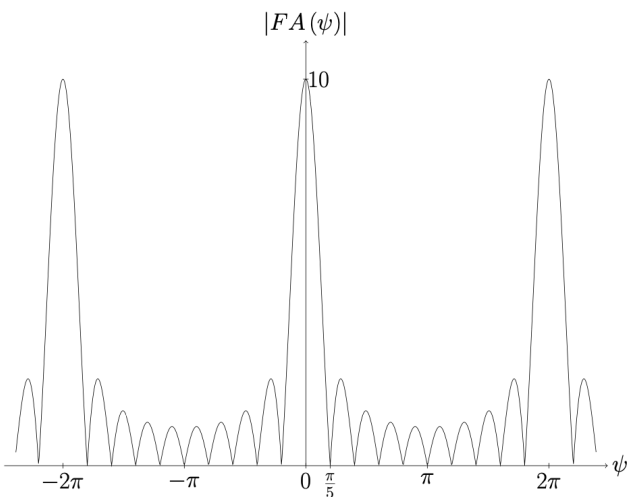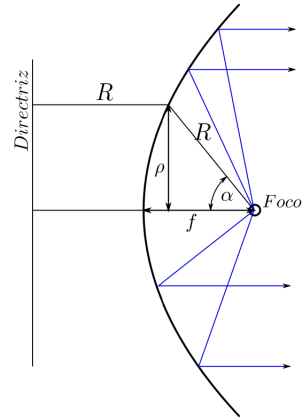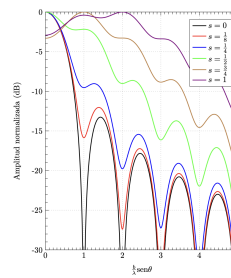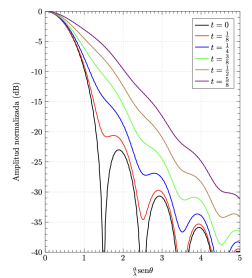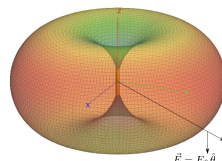
Re $\{Z_{12}\}$
Im $\{Z_{12}\}$
d/λ

Coordenadas esféricas

$P(r, \theta, \varphi)$
z
$\hat{r}$
$\hat{\varphi}$
P
$\hat{\theta}$
r
θ
φ
x
y

$x = r\sin(\theta)\cos(\varphi)$
$y = r\sin(\theta)\sin(\varphi)$
$z = r\cos(\theta)$

Factor de array para N = 10

$|FA(\psi)|$
10
-2π
$-\pi$
0
$\frac{\pi}{5}$
π
2π
ψ