% Graphical construction of array factors for equidistant linearly phased elements
% JR Mosig, January 2002

% Draft for teaching purposes only!!

% Input parameters: n, doverlambda, alphadeg
n=5
doverlambda=0.5
alphadeg=45

kd=2*pi*doverlambda
alpha=alphadeg*pi/180

% c is the cos(theta) ranging between -1 and 1
c=linspace(-1,1,200)
psi=kd*c+alpha
naf=abs(sin(n*psi/2)./(n*sin(psi/2)))

% Plotting the NAF with an offset
subplot(1,2,1)

offset=2
nafplot=naf+offset
plot(c,nafplot)
axis equal
axis([-1 1 0 3])

% Plotting the NAF horizontal axis with the offset
hold on
axehor=offset
plot(c,axehor)

% Plotting the drawing unit circle
hold on
cercle=sqrt(1-c.^2)
plot(c,cercle)

% Plotting the NAF in polar coordinates using values of
% NAF and C previously computed. Although the sought representation
% is in polar coordinates, in order to integrate this drawing in the
% general figure framework, we work with cartesian coordinates X,Y
% directly deduced from RHO=NAF and COS(THETA)= C, and we use PLOT
hold on
rho=naf
x=rho.*c
y=sqrt(rho.^2-x.^2)
```matlab
plot(x,y,'r','LineWidth',2)

subplot(1,2,2)
% Direct plot of the NAF when no geometrical construction is
% required. In this case we compute directly NAF(THETA) and
% plot it in polar coordinates with POLAR
theta=linspace(-pi,pi,361)
psi=kd*cos(theta)+alpha
naf=abs(sin(n*psi/2)./(n*sin(psi/2)))
polar(theta,naf)
zoom on
```