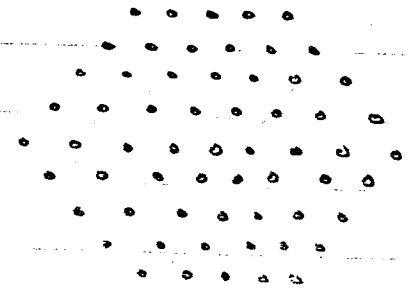
4.4.1 $N_{\#} = 61$, $d = \lambda/2$ (Standard Hexagonal Array)



$N_x = 9$, $R = \frac{N_x}{2} \cdot d = 2.25\lambda$

$$w(n) = \left[1 - \left(r_n/R\right)^2\right]^k$$

a) $k=0$ (uniform)

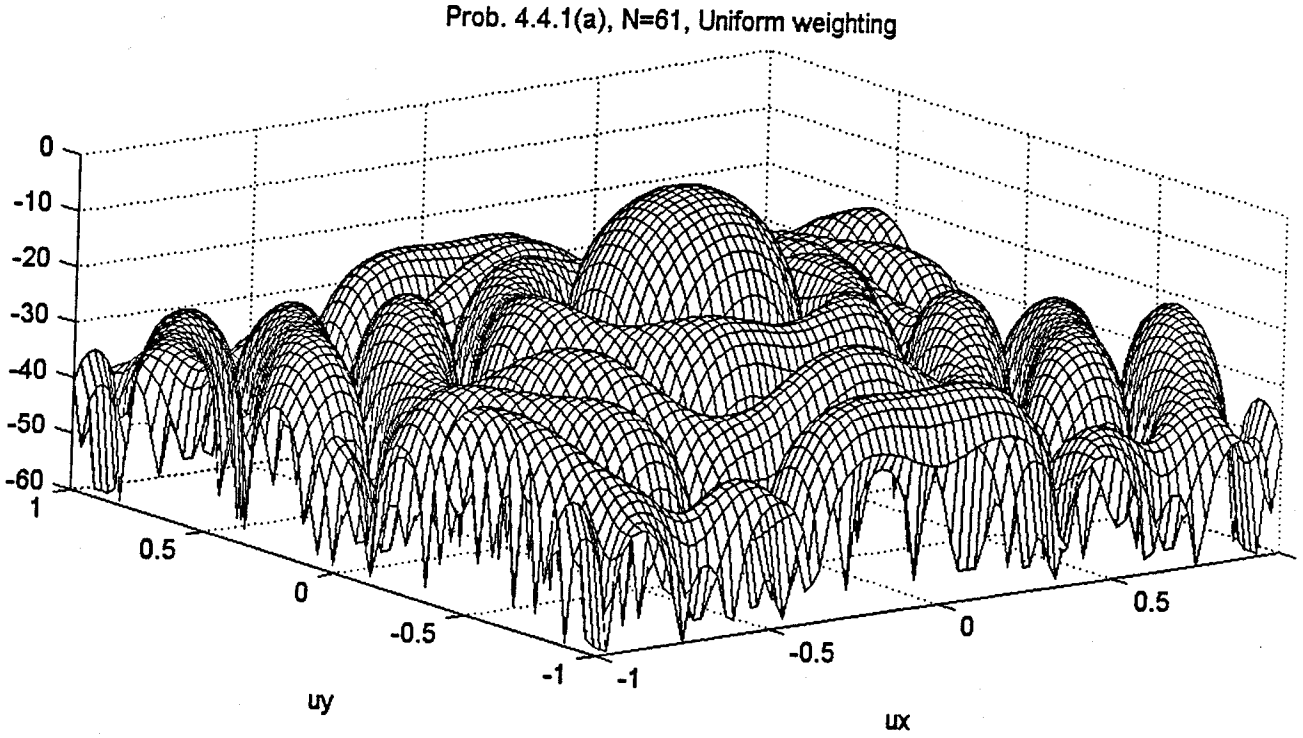
b) $k=1$

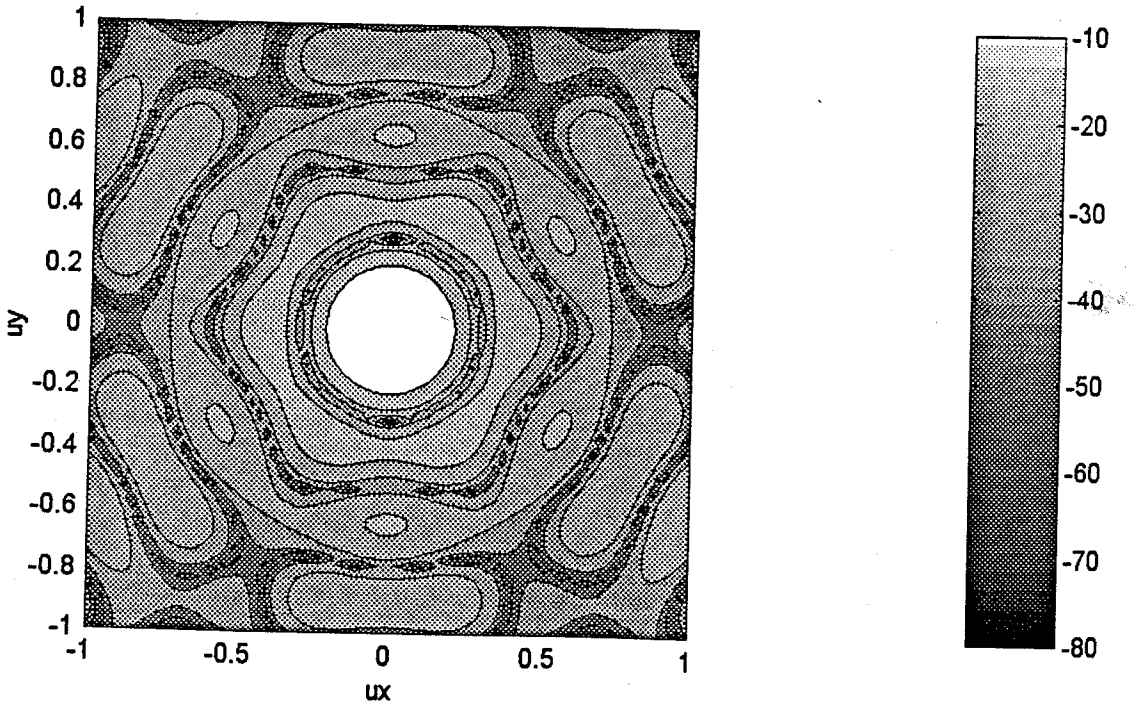
c) $k=2$

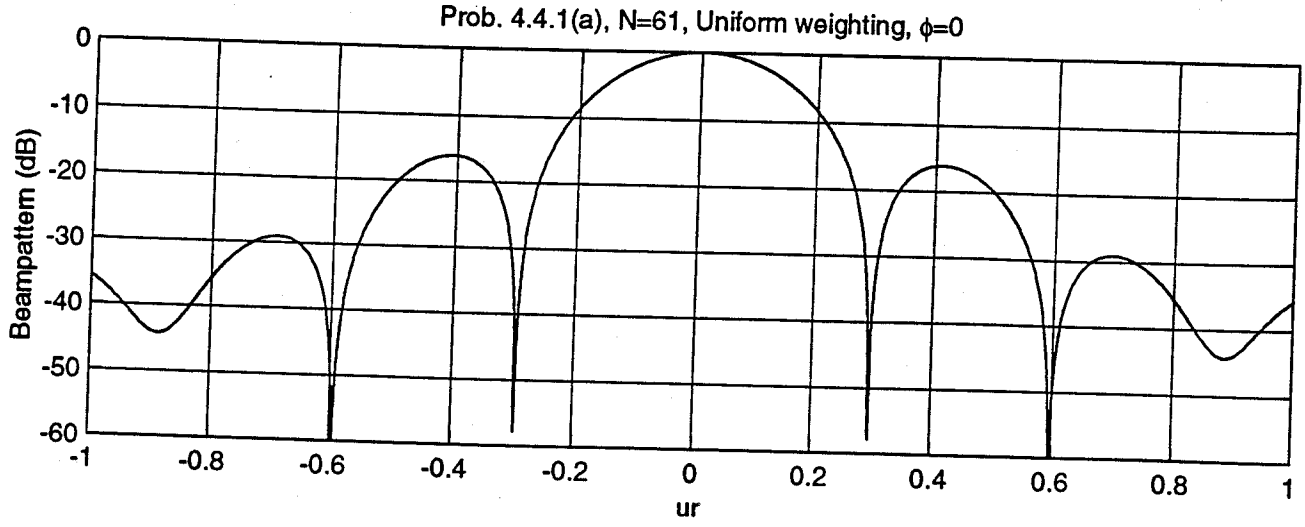
$r_n$ = distance of $n^{th}$ sensor from origin

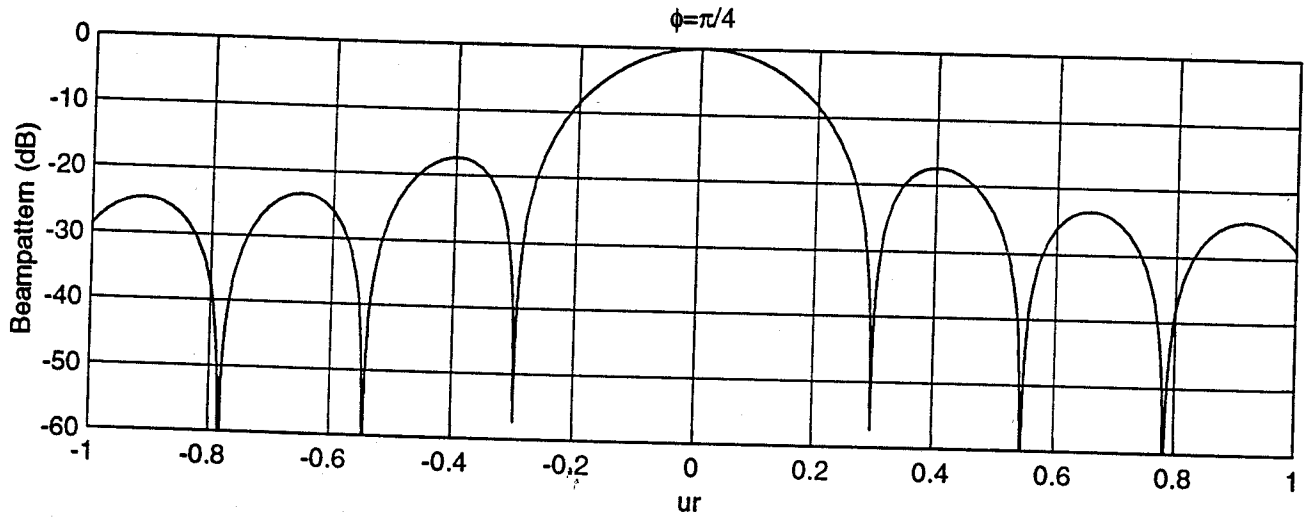
Plots attached

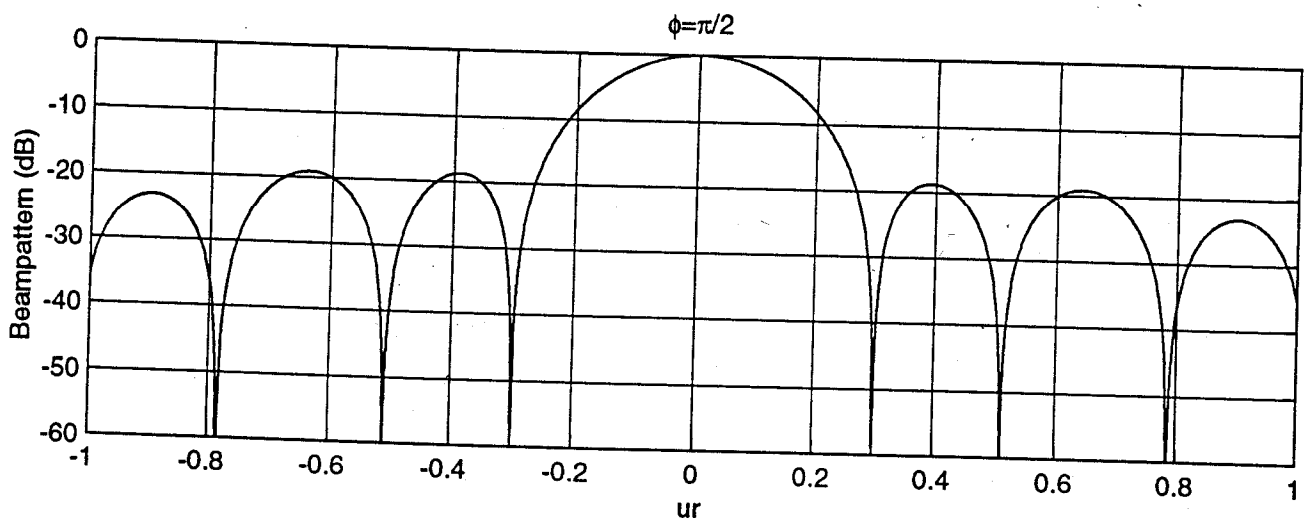
As k increases, beam widens and sidelobes go down. Pattern also becomes more circularly symmetric

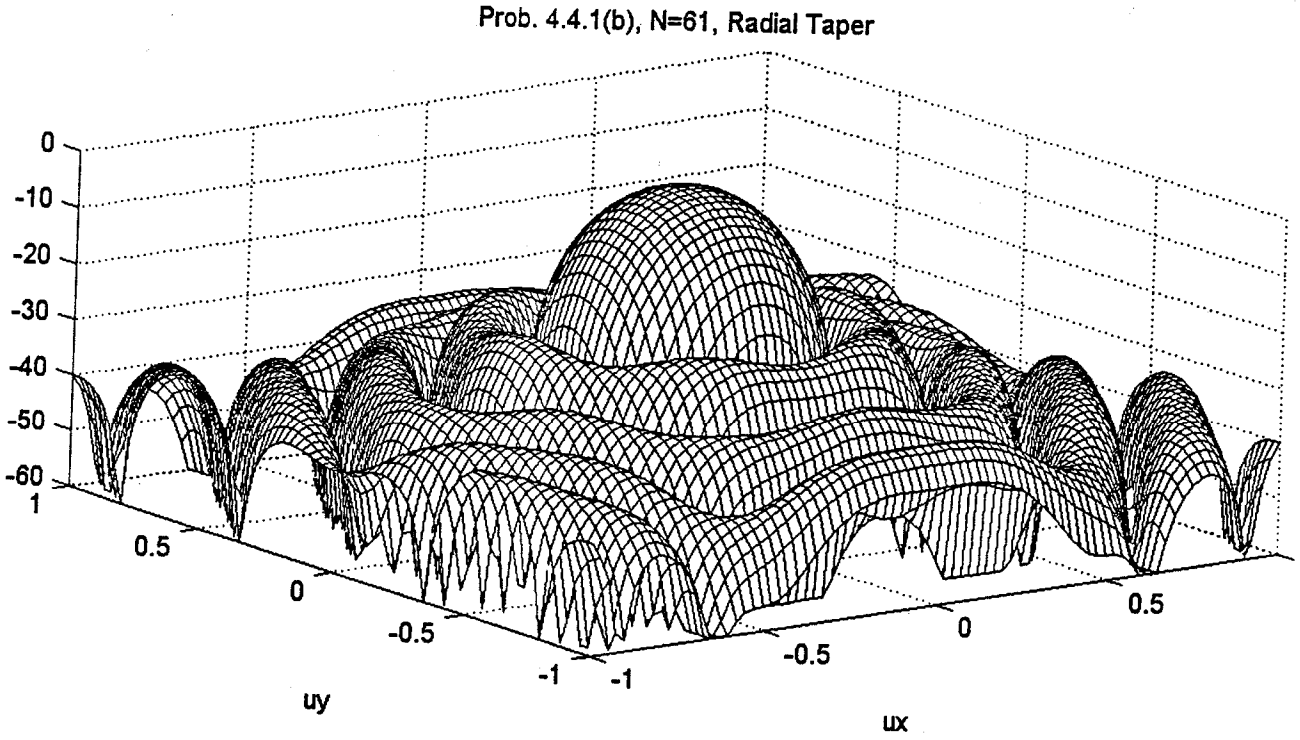

Prob. 4.4.1(a), N=61, Uniform weighting
0
-10
-20
-30
-40
-50
-60
1
0.5
0
-0.5
-1
uy
-1
-0.5
0
0.5
ux

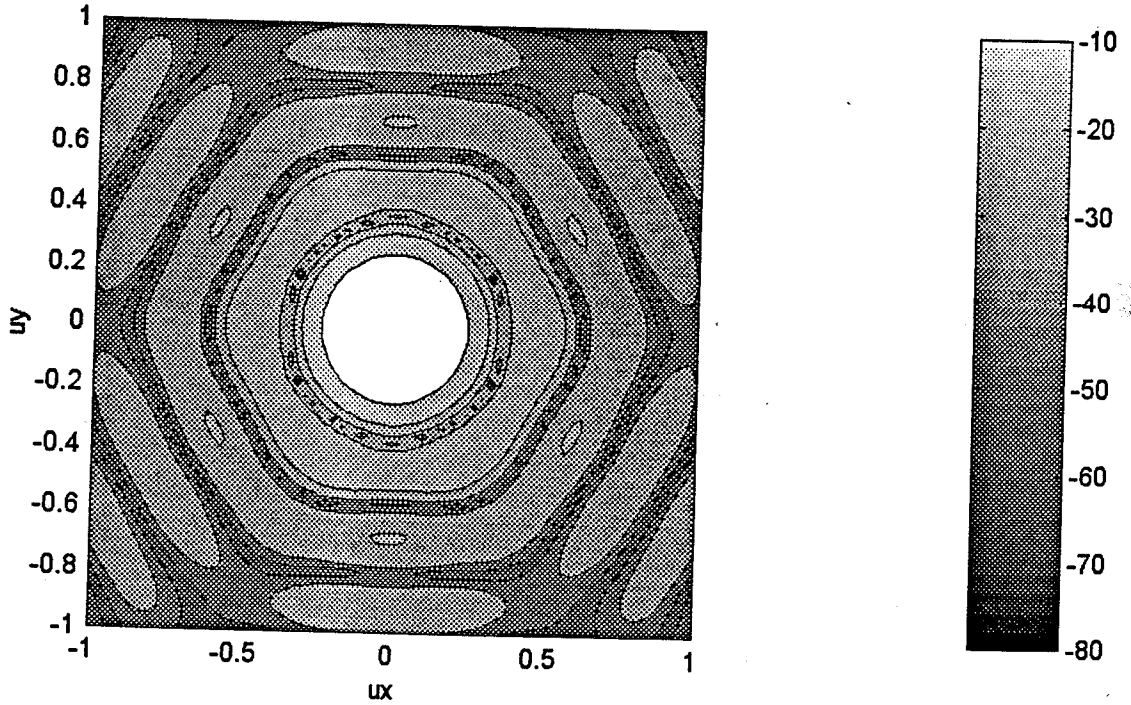

1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
uy
-1
-0.5
0
0.5
1
ux
-10
-20
-30
-40
-50
-60
-70
-80

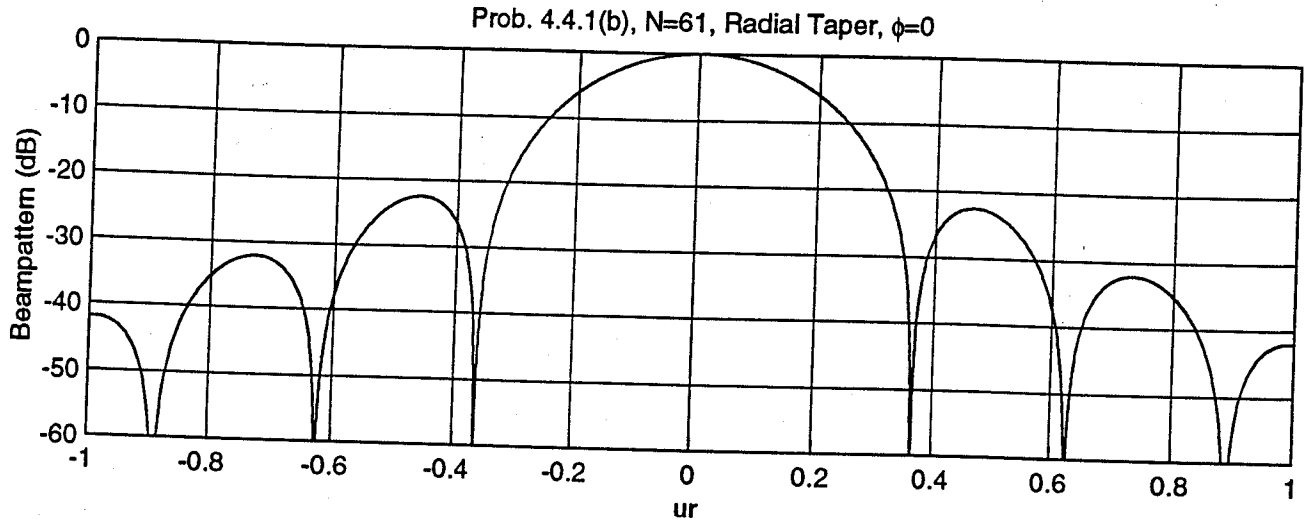

Prob. 4.4.1(a), N=61, Uniform weighting, ϕ=0
Beampattern (dB)
0
-10
-20
-30
-40
-50
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
ur

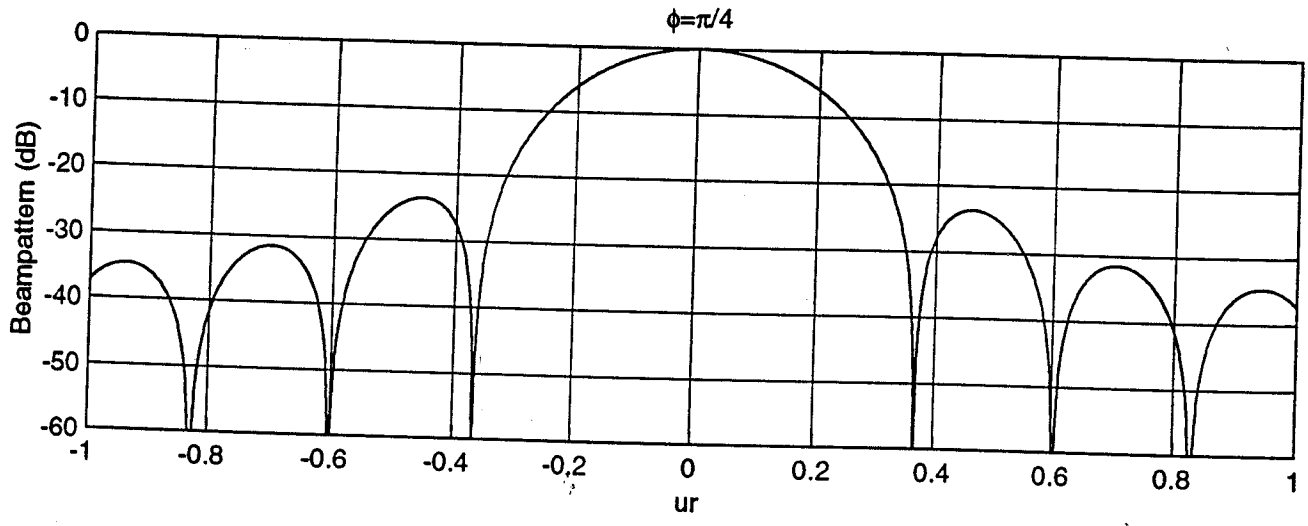

ϕ=π/4
Beampattern (dB)
0
-10
-20
-30
-40
-50
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
ur

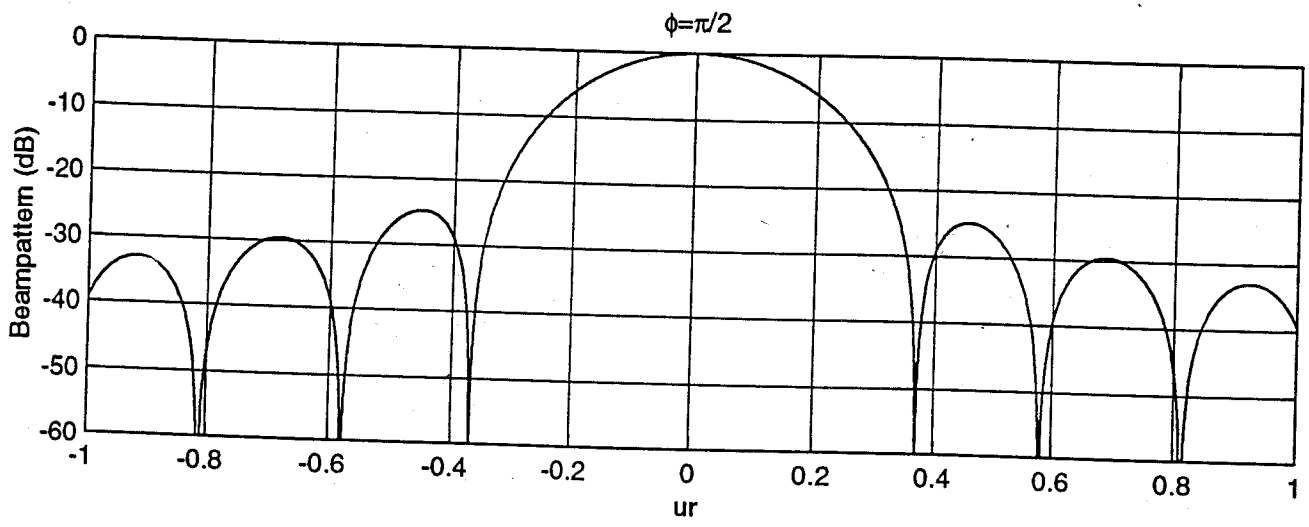

ϕ=π/2
Beampattern (dB)
0
-10
-20
-30
-40
-50
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
ur


Prob. 4.4.1(b), N=61, Radial Taper
0
-10
-20
-30
-40
-50
-60
1
0.5
0
-0.5
-1
uy
-1
-0.5
0
0.5
ux

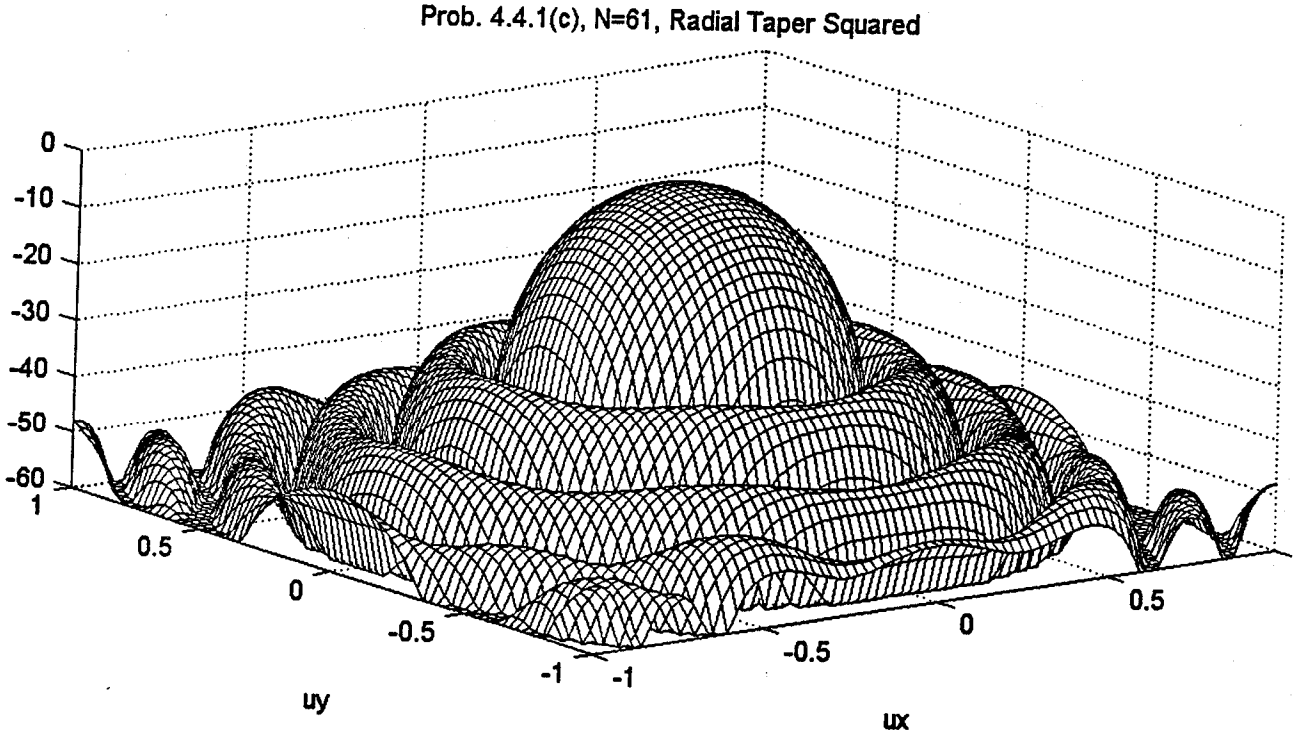

1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
uy
-1
-0.5
0
0.5
1
ux
-10
-20
-30
-40
-50
-60
-70
-80

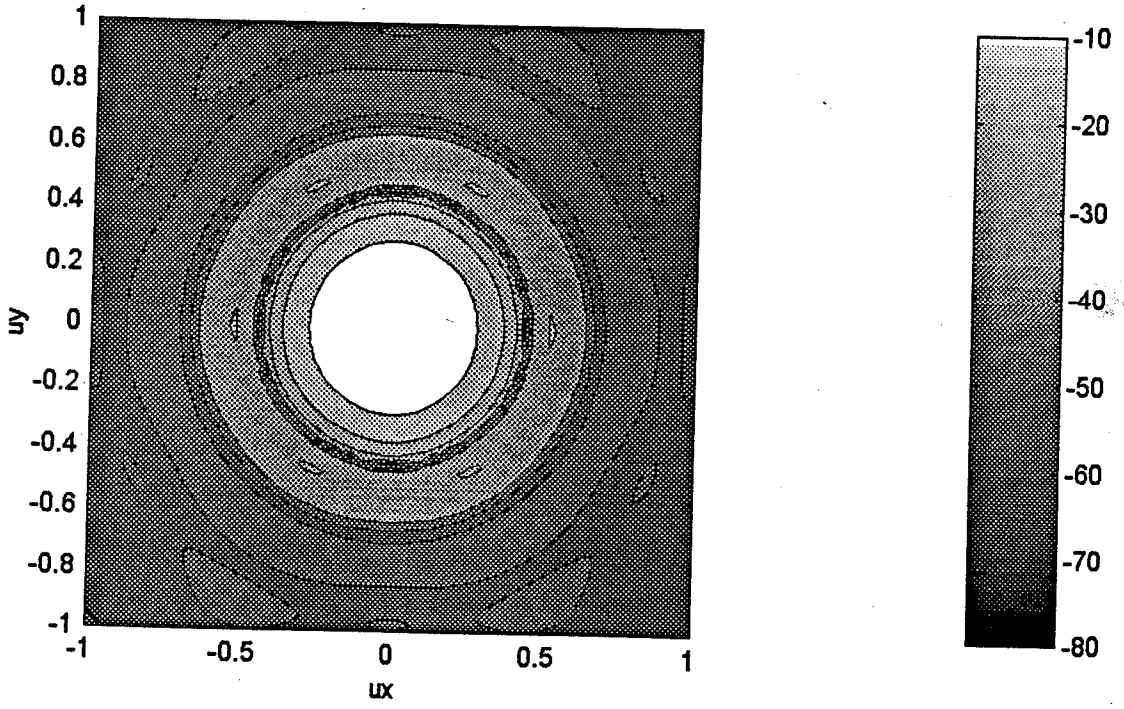

Prob. 4.4.1(b), N=61, Radial Taper, ϕ=0
Beampattern (dB)
0
-10
-20
-30
-40
-50
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
ur

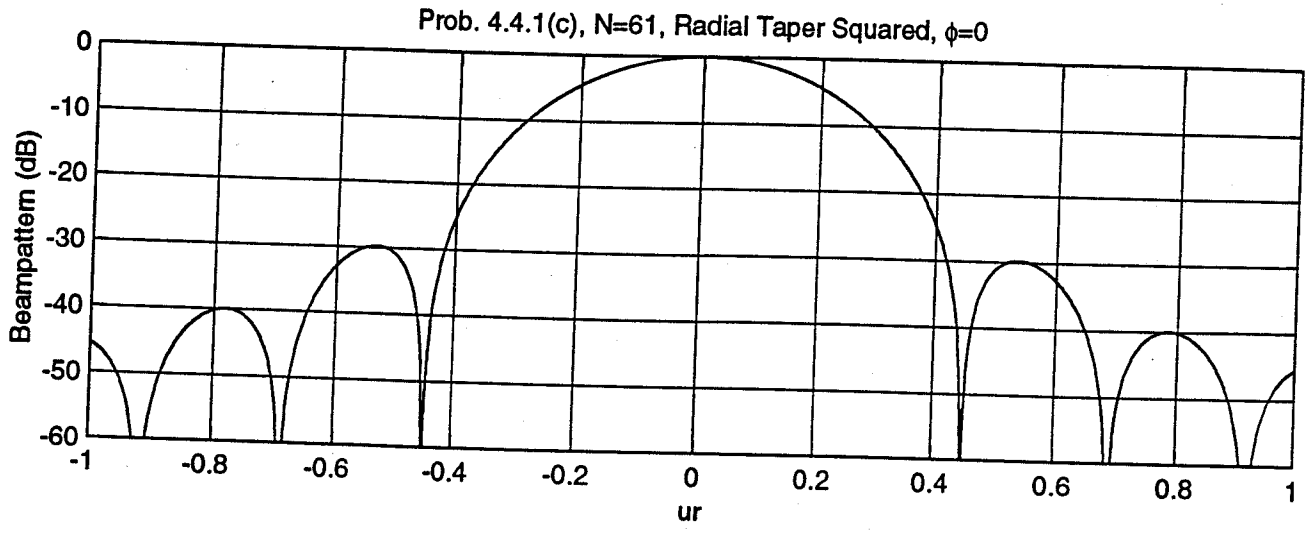

ϕ=π/4
Beampattern (dB)
0
-10
-20
-30
-40
-50
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
ur

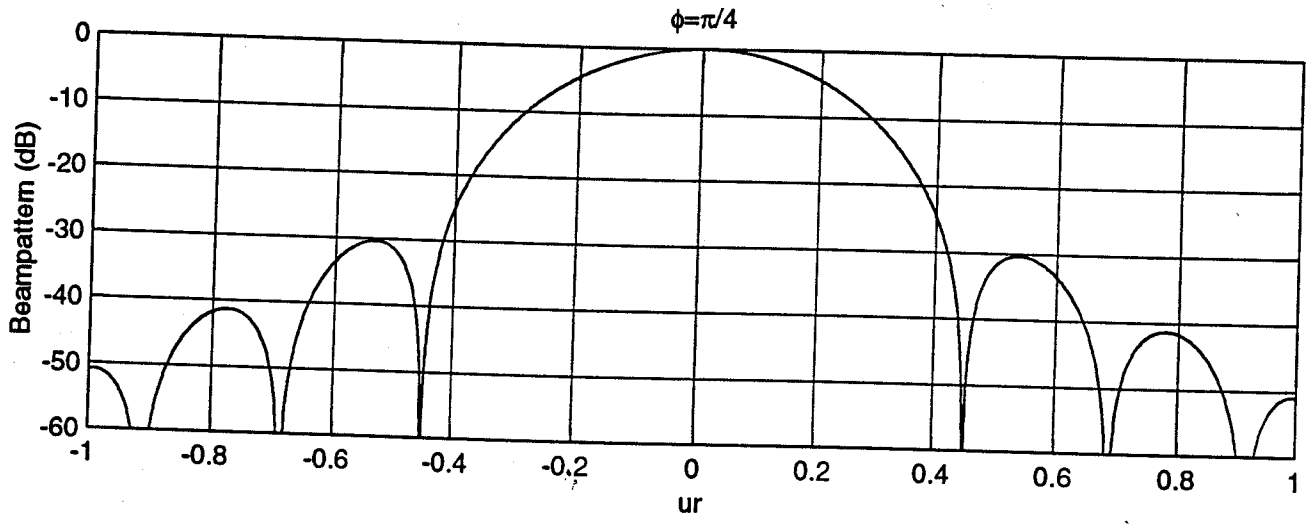

ϕ=π/2
Beampattern (dB)
0
-10
-20
-30
-40
-50
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
ur

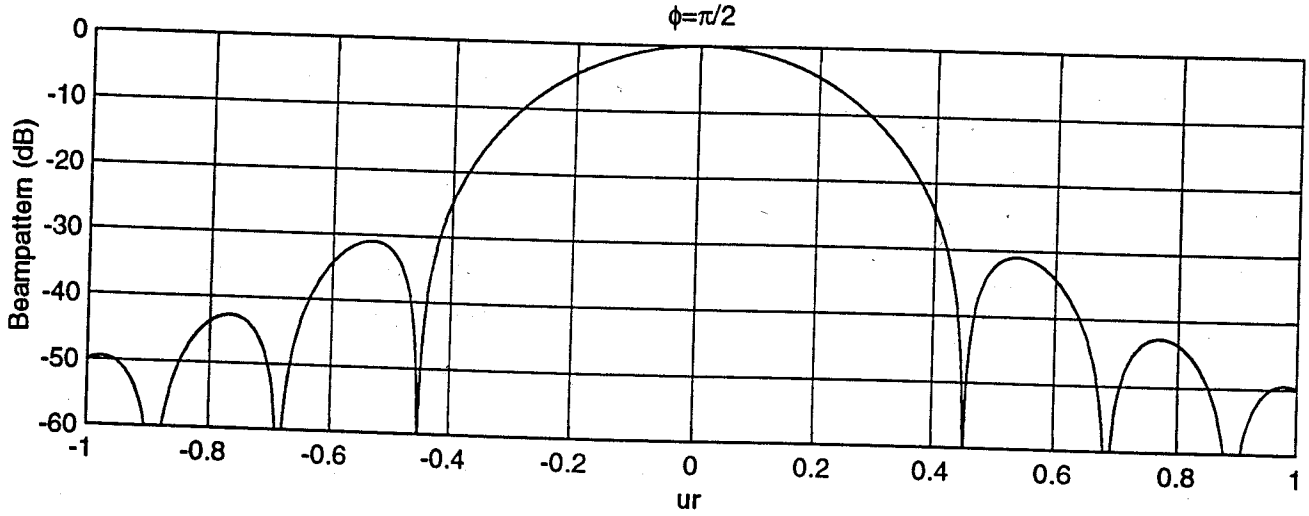
4.4.1 (6)


Prob. 4.4.1(c), N=61, Radial Taper Squared
0
-10
-20
-30
-40
-50
-60
1
0.5
0
-0.5
-1
uy
-1
-0.5
0
0.5
ux


1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
uy
-1
-0.5
0
0.5
1
ux
-10
-20
-30
-40
-50
-60
-70
-80


Prob. 4.4.1(c), N=61, Radial Taper Squared, ϕ=0
Beampattern (dB)
0
-10
-20
-30
-40
-50
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
ur


ϕ=π/4
Beampattern (dB)
0
-10
-20
-30
-40
-50
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
ur


ϕ=π/2
Beampattern (dB)
0
-10
-20
-30
-40
-50
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
ur