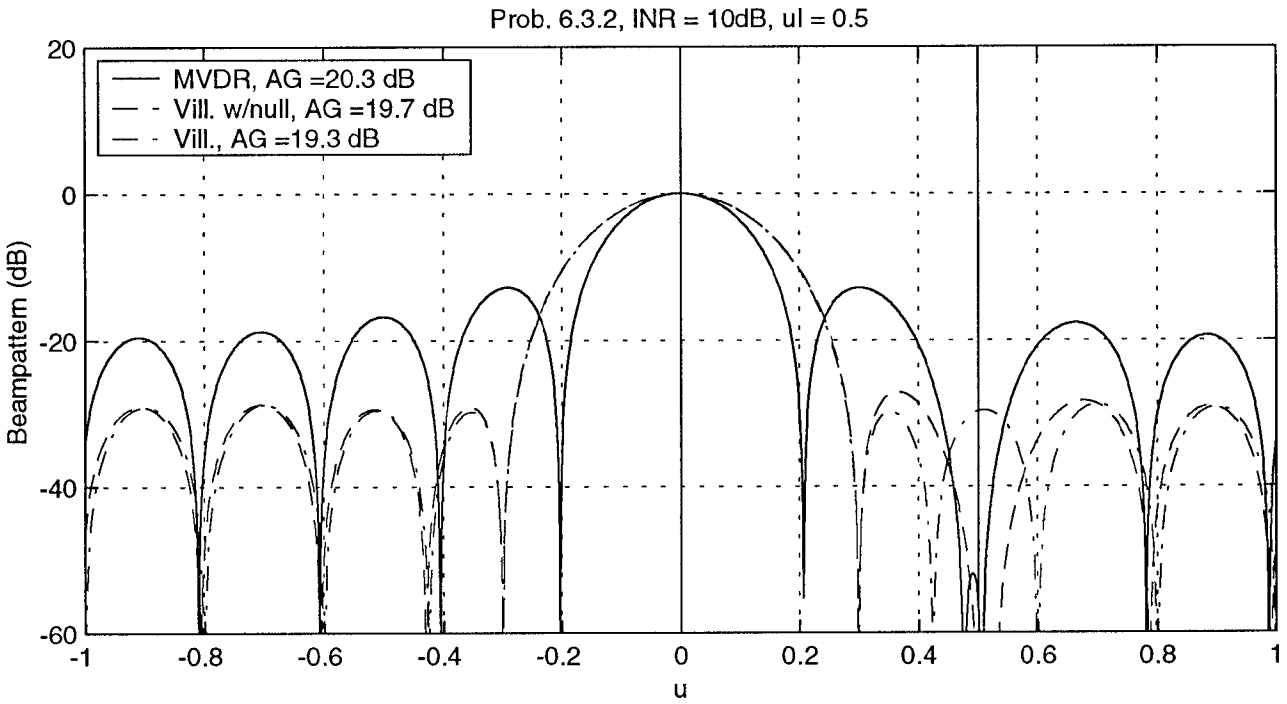
6.3.2 Assume $N=10$ based on ui values wrt mainlobe

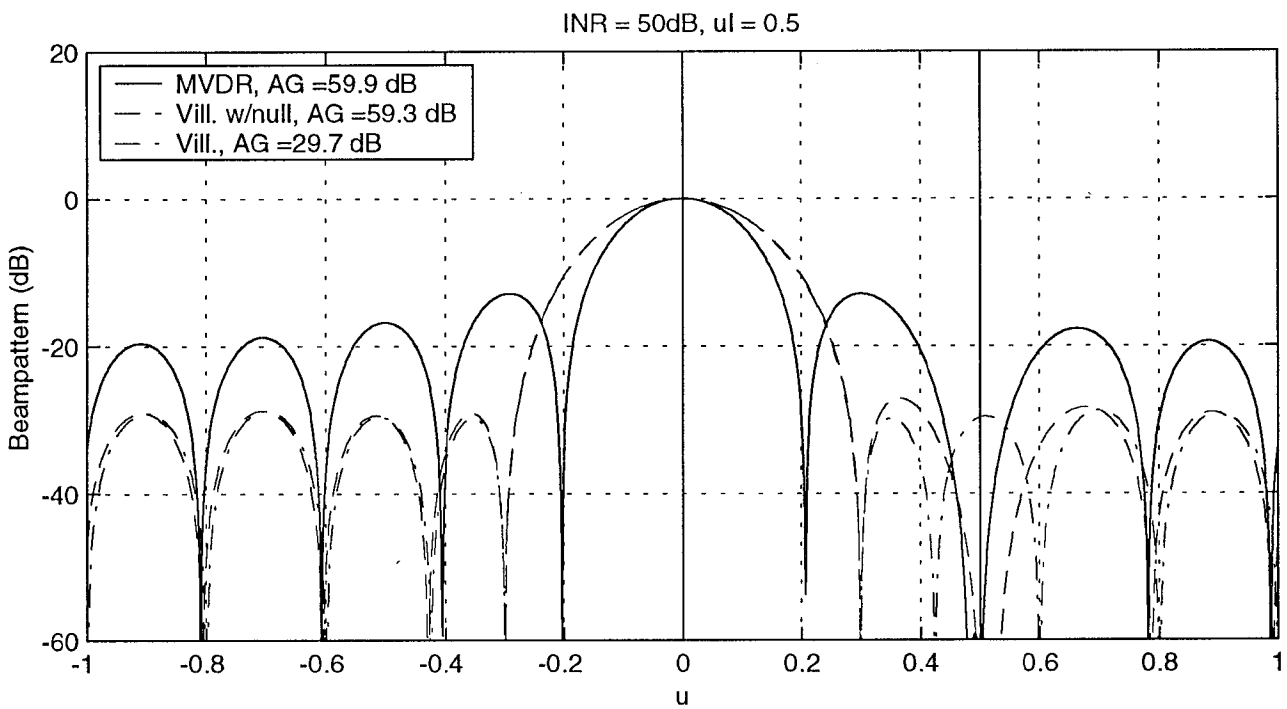
- use $SL = -30$ dB, $\bar{n} = 3$
- plots show beampatterns of MVDR, Villeneuve w/ null, also Vill. w/o null for comparison

- the null steered Villeneuve beamformer has a slight lower array gain than the MVDR beamformer when the interferer is in the sidelobe region, but has lower sidelobes (and a wider main beam).

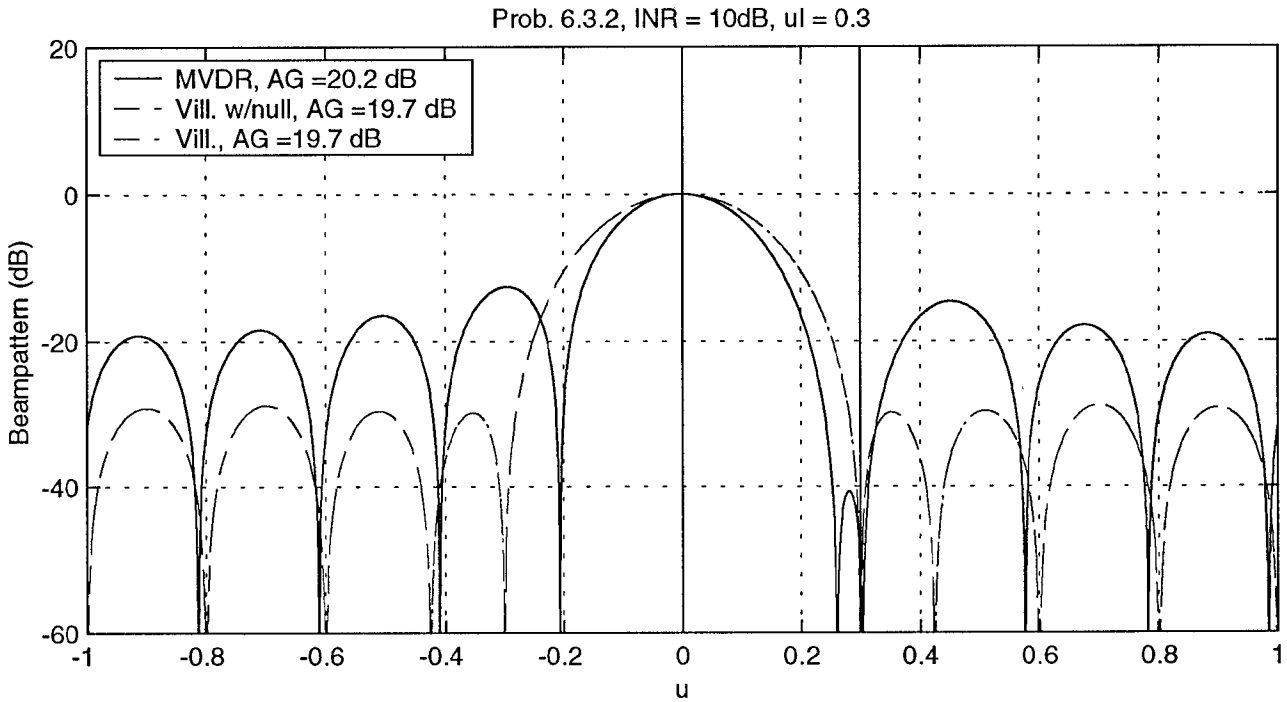
- the difference in performance becomes more pronounced when the interferer moves inside the main beam, due to significantly reduced gain to the desired signal in the Villeneuve beamformer.

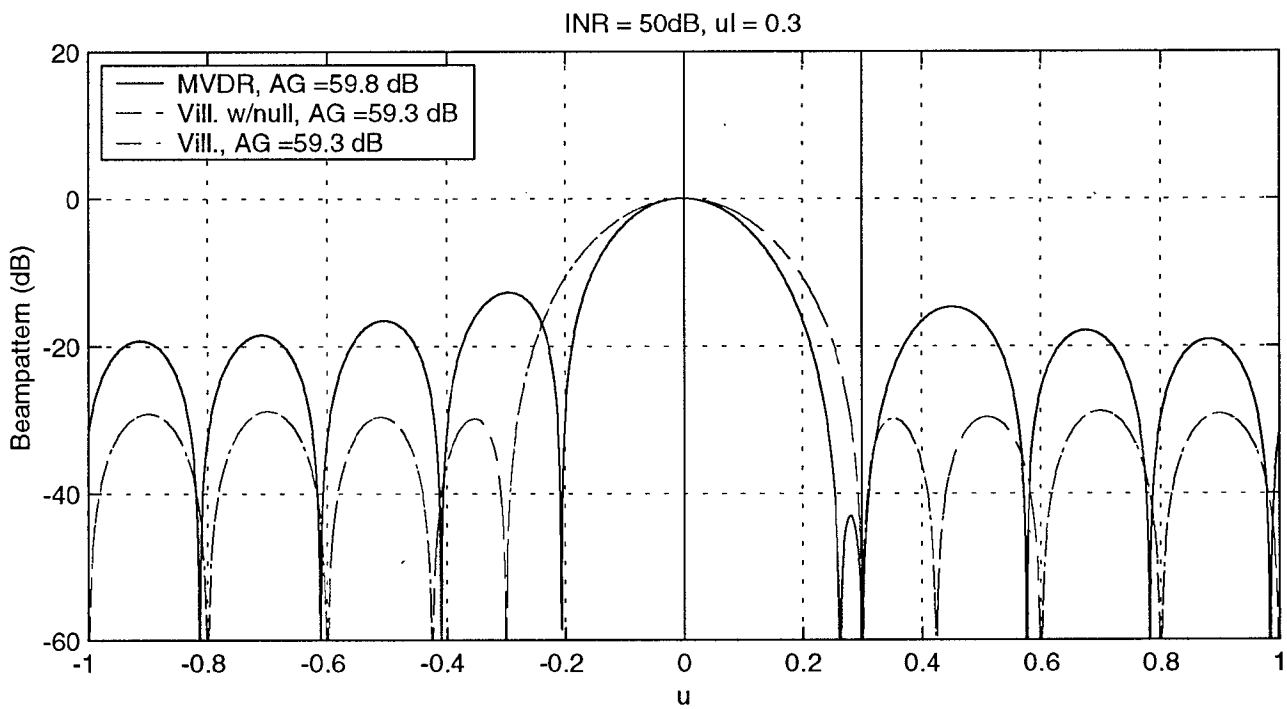
- the Villeneuve w/o nulls has much lower array gain at sidelobe peaks and inside the main beam, especially for high INR, due to inability to null interferer.


Prob. 6.3.2, INR = 10dB, ul = 0.5
MVDR, AG =20.3 dB
Vill. w/null, AG =19.7 dB
Vill., AG =19.3 dB
Beampattern (dB)
20
0
-20
-40
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
u

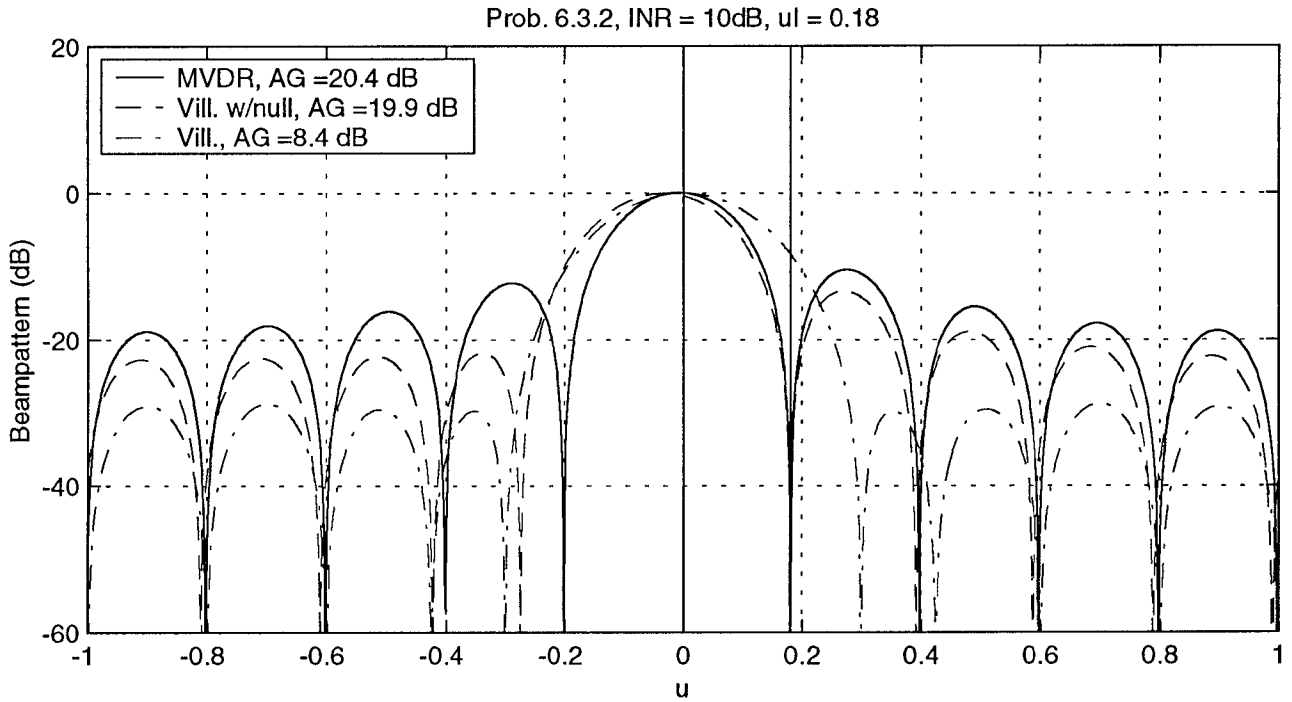

INR = 50dB, ul = 0.5
MVDR, AG =59.9 dB
Vill. w/null, AG =59.3 dB
Vill., AG =29.7 dB
Beampattern (dB)
20
0
-20
-40
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
u

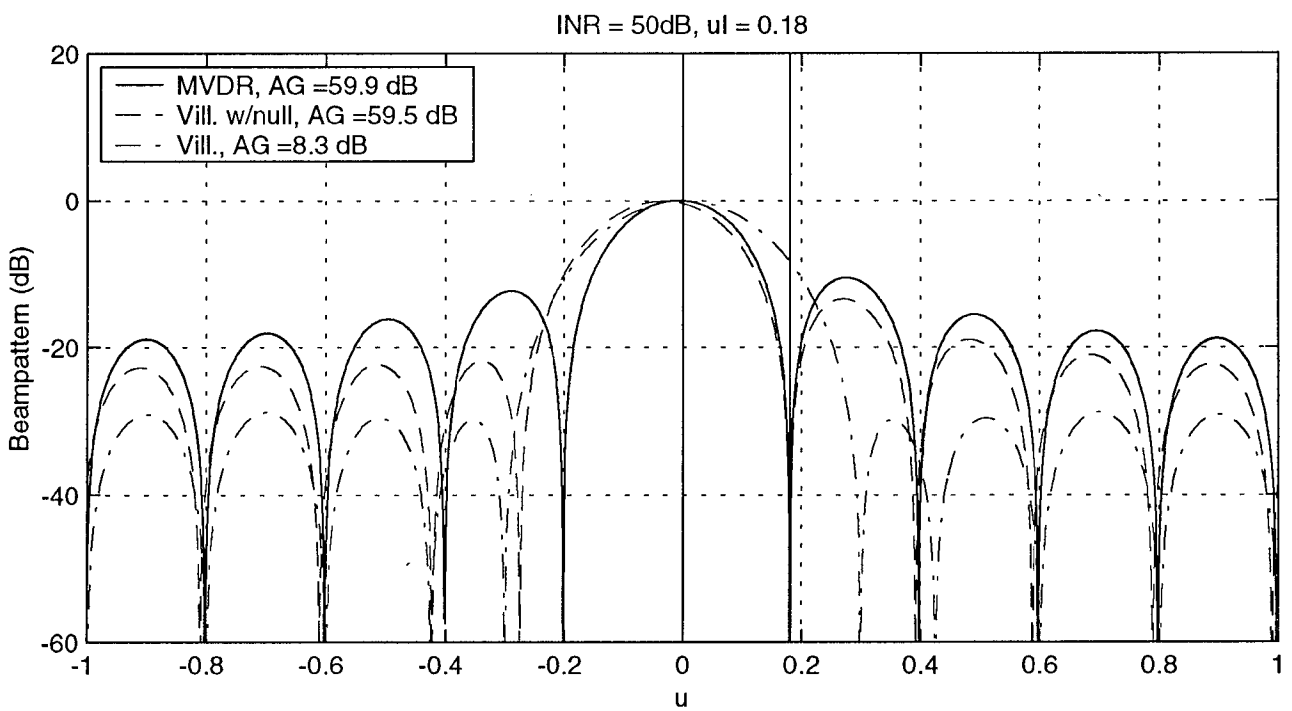
6.3.2 3/10

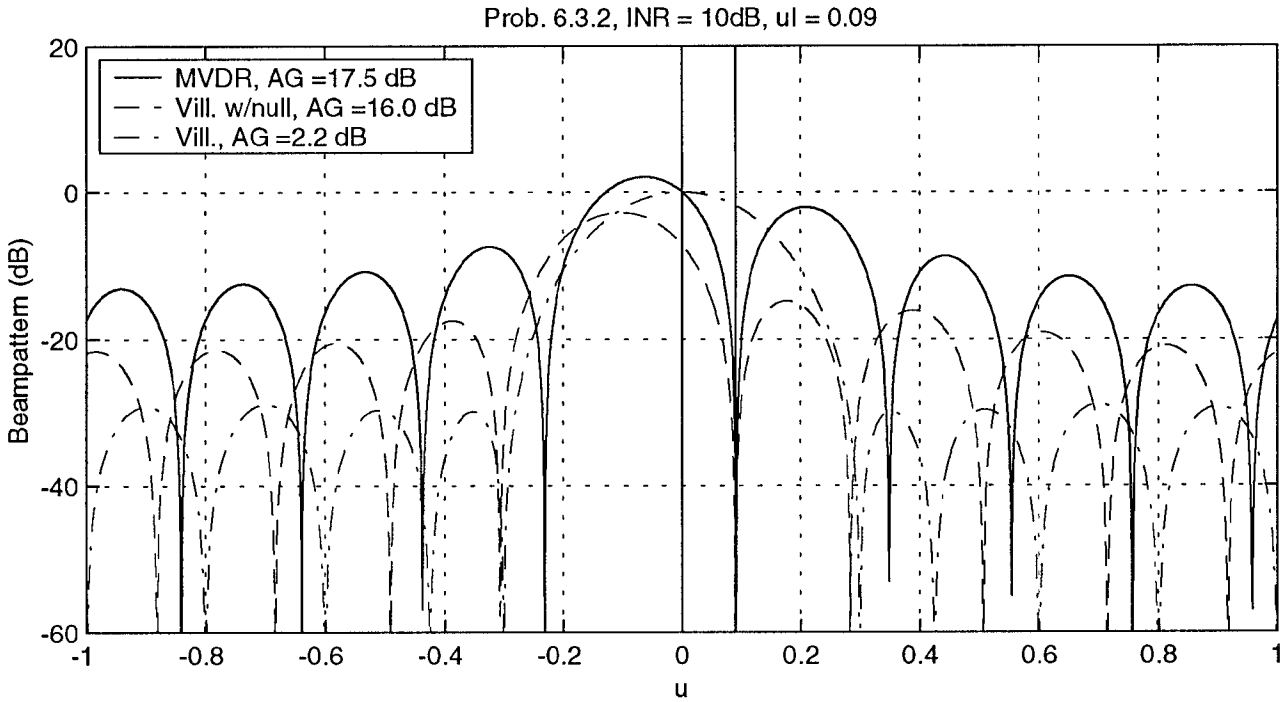

Prob. 6.3.2, INR = 10dB, ul = 0.3
MVDR, AG =20.2 dB
Vill. w/null, AG =19.7 dB
Vill., AG =19.7 dB
Beampattern (dB)
u
20
0
-20
-40
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

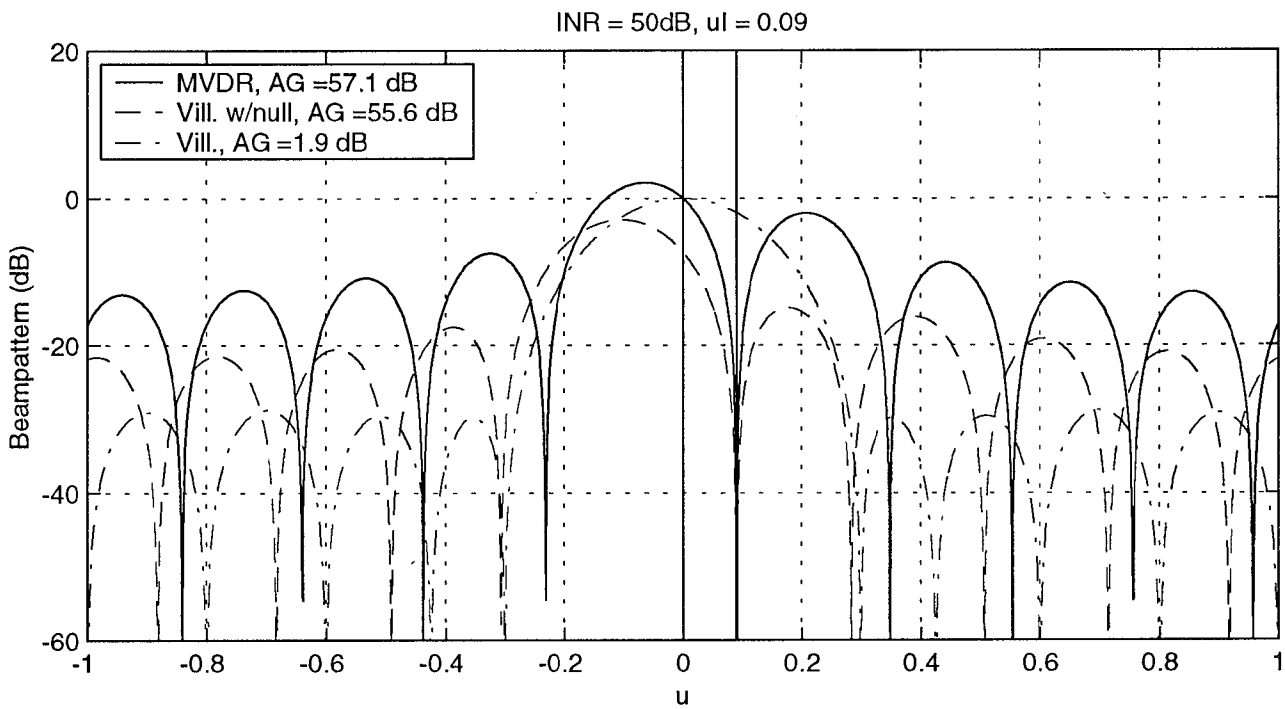

INR = 50dB, ul = 0.3
MVDR, AG =59.8 dB
Vill. w/null, AG =59.3 dB
Vill., AG =59.3 dB
Beampattern (dB)
u
20
0
-20
-40
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1

6.3.2 4/10

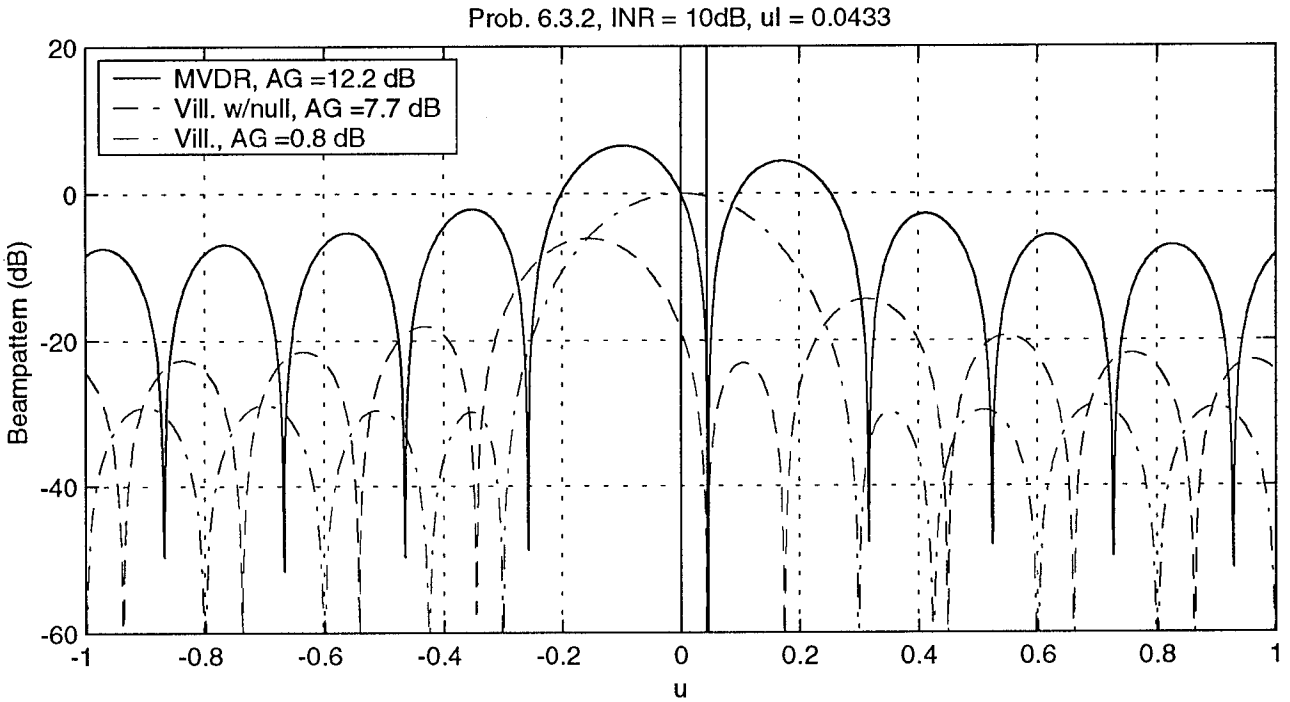

Prob. 6.3.2, INR = 10dB, ul = 0.18
MVDR, AG =20.4 dB
Vill. w/null, AG =19.9 dB
Vill., AG =8.4 dB
Beampattern (dB)
20
0
-20
-40
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
u

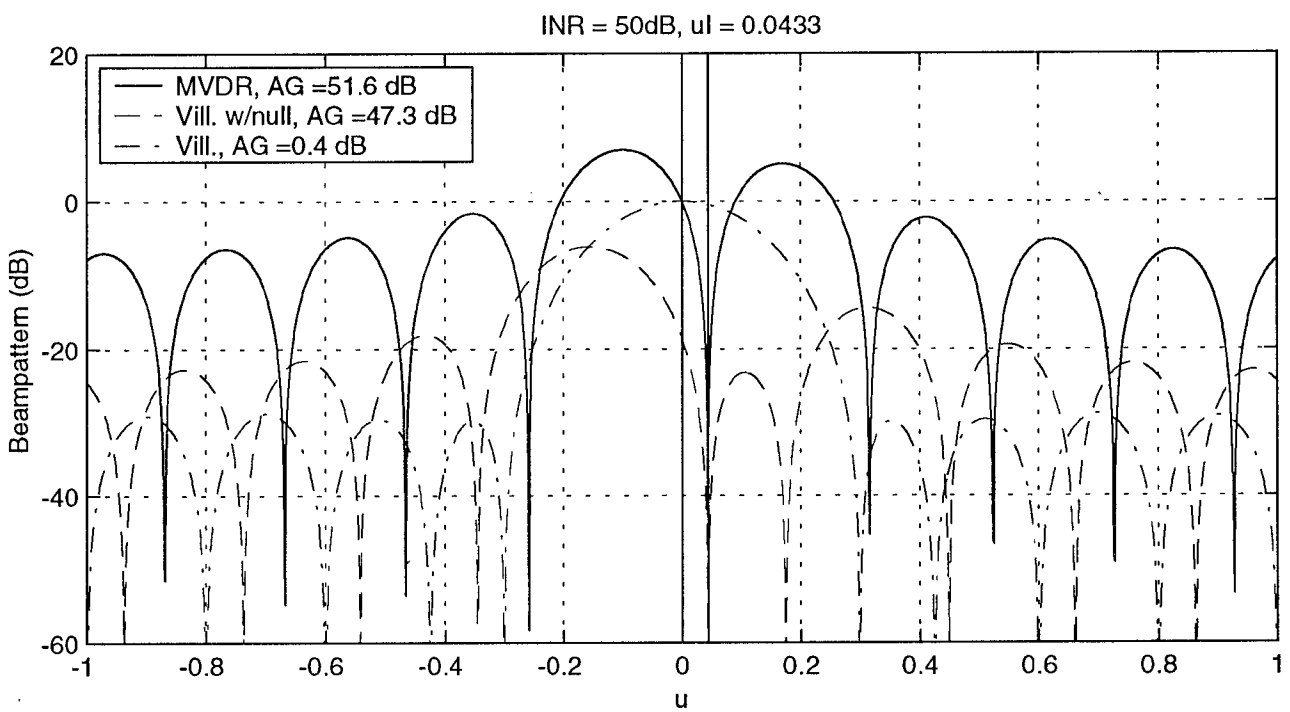

INR = 50dB, ul = 0.18
MVDR, AG =59.9 dB
Vill. w/null, AG =59.5 dB
Vill., AG =8.3 dB
Beampattern (dB)
20
0
-20
-40
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
u


Prob. 6.3.2, INR = 10dB, ul = 0.09
MVDR, AG =17.5 dB
Vill. w/null, AG =16.0 dB
Vill., AG =2.2 dB
Beampattern (dB)
20
0
-20
-40
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
u

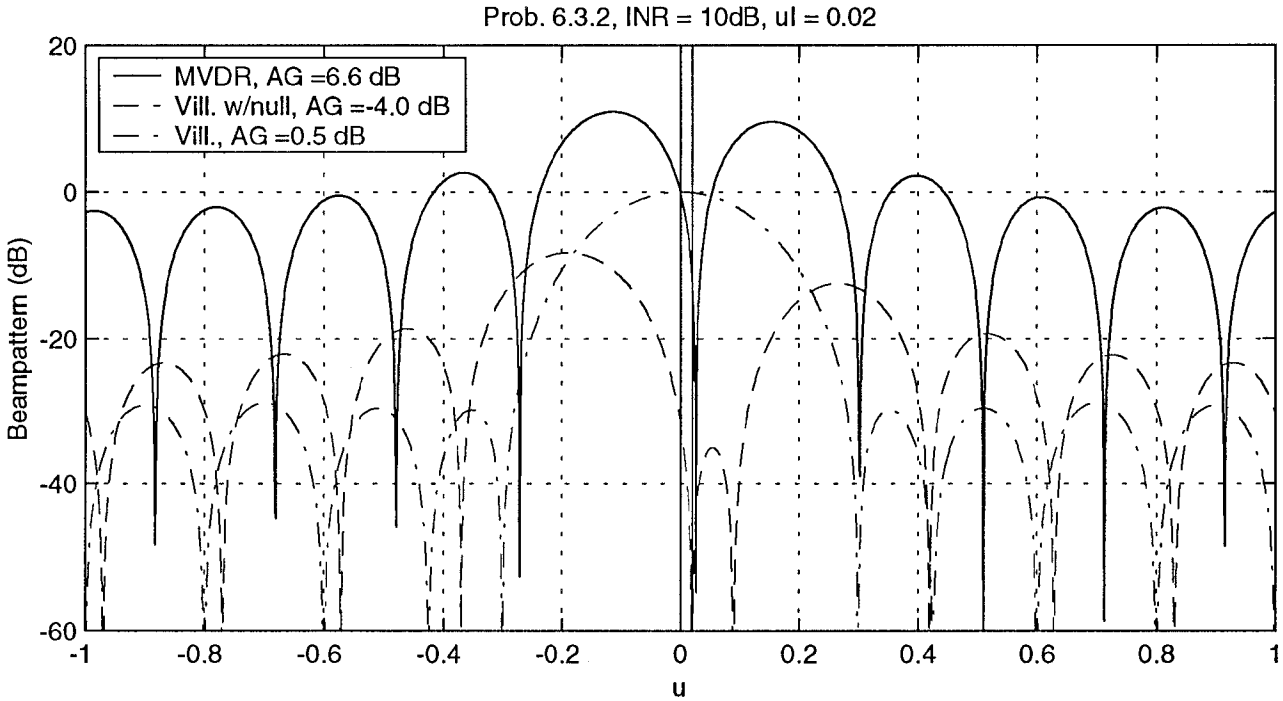

INR = 50dB, ul = 0.09
MVDR, AG =57.1 dB
Vill. w/null, AG =55.6 dB
Vill., AG =1.9 dB
Beampattern (dB)
20
0
-20
-40
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
u

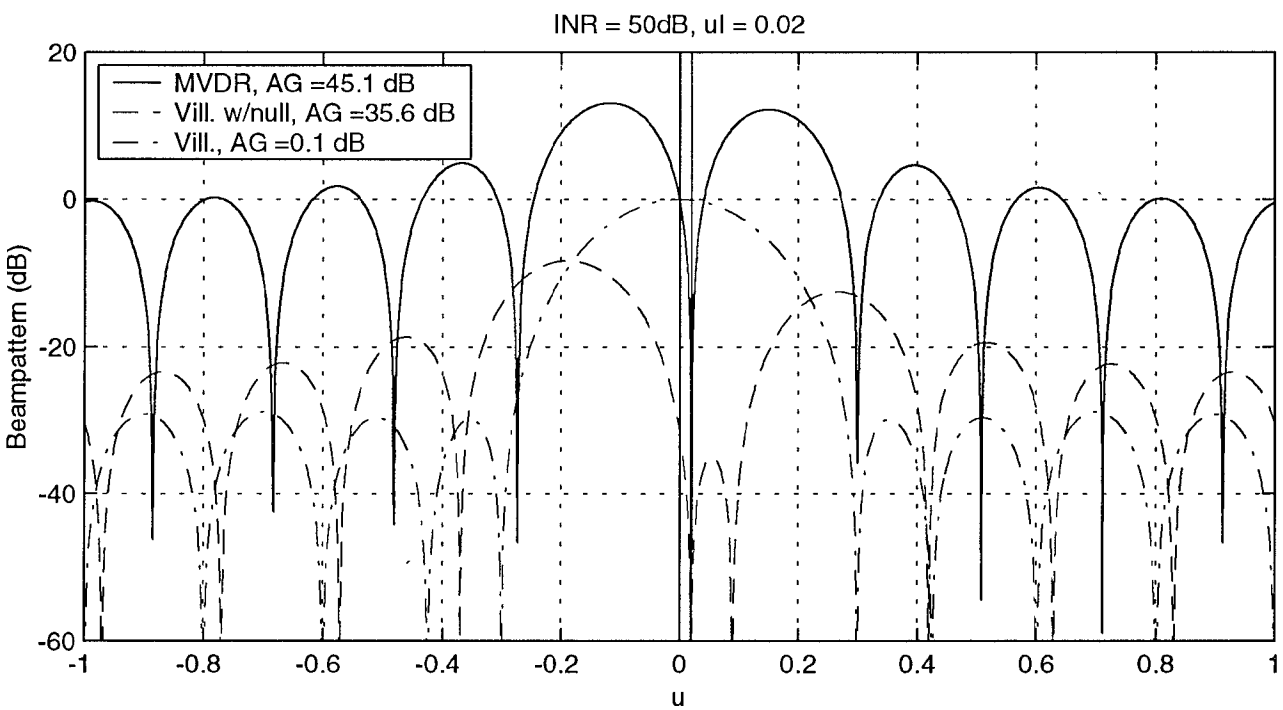
6.3.2 6/10


Prob. 6.3.2, INR = 10dB, ul = 0.0433
MVDR, AG =12.2 dB
Vill. w/null, AG =7.7 dB
Vill., AG =0.8 dB
Beampattern (dB)
20
0
-20
-40
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
u

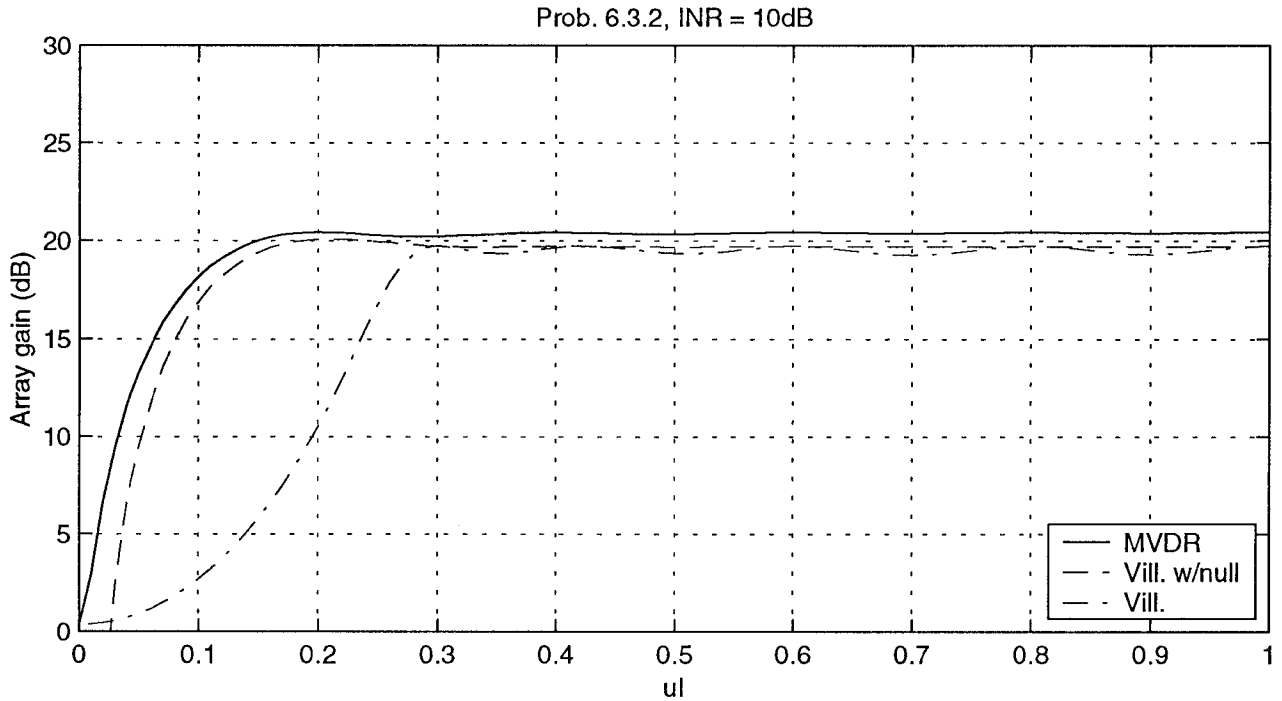

INR = 50dB, ul = 0.0433
MVDR, AG =51.6 dB
Vill. w/null, AG =47.3 dB
Vill., AG =0.4 dB
Beampattern (dB)
20
0
-20
-40
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
u

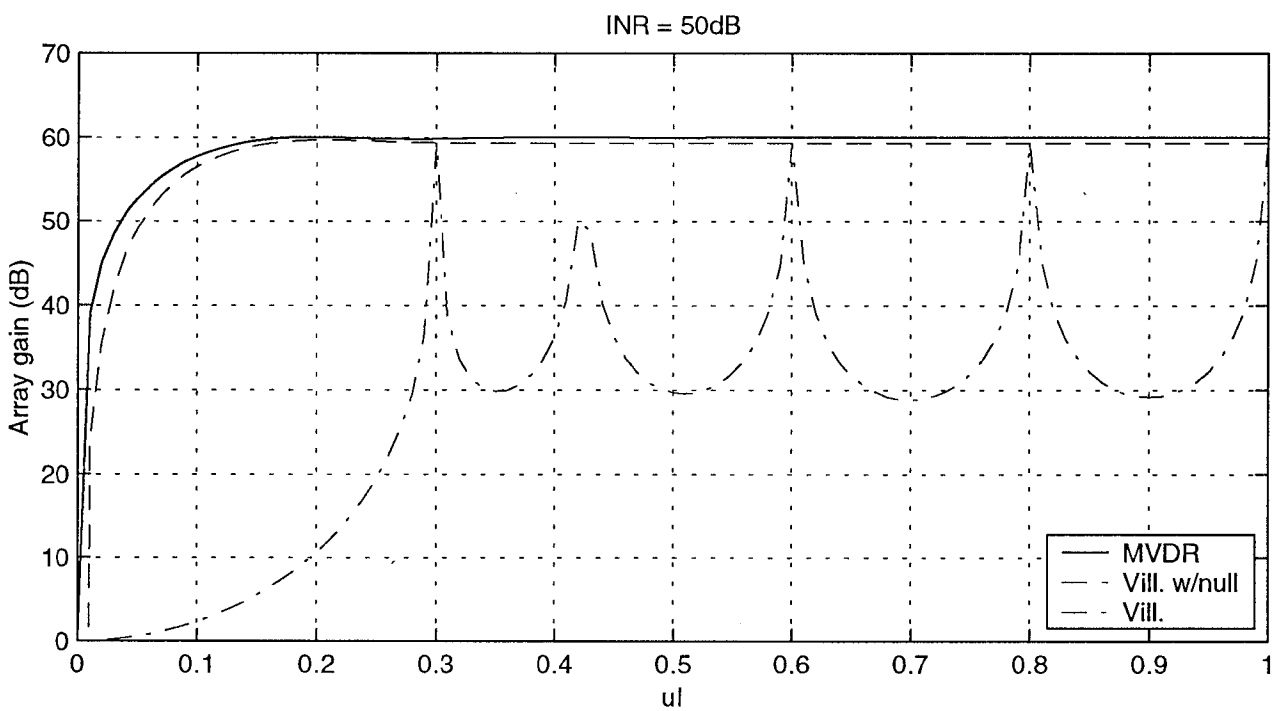
6.3.2 7/10


Prob. 6.3.2, INR = 10dB, ul = 0.02
MVDR, AG =6.6 dB
Vill. w/null, AG =-4.0 dB
Vill., AG =0.5 dB
Beampattern (dB)
20
0
-20
-40
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
u


INR = 50dB, ul = 0.02
MVDR, AG =45.1 dB
Vill. w/null, AG =35.6 dB
Vill., AG =0.1 dB
Beampattern (dB)
20
0
-20
-40
-60
-1
-0.8
-0.6
-0.4
-0.2
0
0.2
0.4
0.6
0.8
1
u

6.3.2 8/10


Prob. 6.3.2, INR = 10dB
Array gain (dB)
ul
MVDR
Vill. w/null
Vill.
0
5
10
15
20
25
30
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1


INR = 50dB
Array gain (dB)
ul
MVDR
Vill. w/null
Vill.
0
10
20
30
40
50
60
70
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1