(54)

'

.

SNR ,

.

3

' ' ' '

1 .
2 1 .
3 1 .

4   M = 2, L = 32   1   (A $_1$, A $_2$)   2   (B $_1$, B $_2$)
.

5   .
6   3   (145)   .
7   1   .
8   2   .

< >
100, 100' :
110 :
120 :   /
130 :
140 : A /D
150, 150' :
155 :
160 :
170 :

'   .

'   '
(plane images)   '
.

(SNR)   .   '
.   '   (axial direction)
.   '   .
'
'   '
                                                        '   SNR
'
.

,   1   - 1   (biphase)
.   '

.   .
(complementary biphase sequences)   .
,   L   M   1   .

1

$$A_i = [a_{i1}, \ a_{i2}, \ \cdots, a_{iL}], \quad i = 1, 2, \cdots, M$$

2   '
.

2

$$x(k) = \sum_{i=1}^{M} \sum_{l=1}^{L-k} a_{il} \ a_{i,l+k}^{*} = ML\delta(k), \ k = 0, 1, \cdots, L-1$$

, (k) (dirac function) .

1 . 1 ,
(100), (array transducer)(110), / (120),
(130), A /D (140), (150), (155), (160) (1
70) .
(100) (110) , (110)
.

(transmit focusing) . ,

.

(synthetic aperture method) .
/ (120) (100) (130)
. , , (100) (13
0) .
(110) (128) , (100)
.

, 128 , (apertu
re) 64 (scan line) .
(130) , (110) (aliasing) ,
A /D (140) . A /D
(140) (130) , (150)
. (150) A /D (140) (amount of delay) [
(focusing)] (dynamic)
.
(155) (150)

, (150)
.
(160) (155) (baseband signals)
(quadrature demodulator) (envelope)
.
(170) (160) ( ) , .

2 1 .
, 2 , L M = 2 (A $_1$, A $_2$)
, (focal point) P .
, PRI(pulse repetition interval) 1 , (110)
(1a 1h) 1 A $_1$ P ,
.
, PRI 2 , (1a 1h) 2
A $_2$ P . .
(scan line) .
, (1a 1h) (pulse compression)
. ,
, ,
, M . ,
(frame rate) 1/M .

, SNR
. .

- 3 -

1

M
- M - M
M
M M
M
M

2 M
- M - M
M M
M M
M
M

1 2

(orthogonality)

2 (, A $_1$, A $_2$)
(, B $_1$, B $_2$) 3
M

3

$$x(k) = \sum_{i=1}^{M} \sum_{l=1}^{L-k} a_{il} b_{i,l+k}^{*} = 0, \quad k = 0,1,\cdots,L-1$$

(A $_1$, A $_2$)
(B $_1$, B $_2$)
< 1 >
3 [(A $_1$, A $_2$) (B $_1$, B $_2$)] 1
. 3 , (100'), (145)
(150') 1

(100') 1 (A $_1$, A $_2$) 2 (B $_1$, B $_2$)
. , 1 (A $_1$, A $_2$) n , 2
(B $_1$, B $_2$) n+ 1
4 M = 2, L = 32 1 (A $_1$, A $_2$) 2 (B $_1$, B $_2$)
. ,
. ,
. 5 (a) (d)
(100') 1 1 A $_1$ 1 B $_1$
X (A $_1$ + B $_1$) (110) (1a ~ 1h)
, 2 2 A $_2$ 2 B $_2$
Y (A $_2$ + B $_2$) . , (100')
. (100) {+ 1, - 1}
(100')
(A $_1$ B $_1$ A $_2$ B $_2$) {+ 2, + 1, 0, - 1, - 2} (, M
2M+ 1) .
5 (e), (f) . 7 8 .
(145) A /D (140) (150) , X (A $_1$ + B $_1$)
Y (A $_2$ + B $_2$) X' (A $_1$ + B $_1$) Y' (A $_2$ + B $_2$)
n n+ 1 . ,
n (, A $_1$, A $_2$) n+ 1 (, B $_1$, B $_2$)
, (145) (150')

6 3 (145) . , (145)

M . M = 2 , 2

(146, 148) . , (147, 149)

. 1 (146) X'(A$_1$+B$_1$) A$_1$ Y'(A$_2$+B$_2$)

A$_2$ 1 (147) . 1 (147) A$_1$ A$_2$ n

RF (150') 1 (151) . , 2 (148)

X'(A$_1$+B$_1$) B$_1$ Y'(A$_2$+B$_2$) B$_2$ 2

(149) . 2 (149) B$_1$ B$_2$ n+1 RF

(150') 2 (152) .

(150') (145) RF RF .

n RF n+1 RF ,

(150') , 1 (151) 2 (152)

. 1 (151) 1 (146) (147) n RF

P , 2 (152) 2 (147) (

148) n+1 RF Q . ,

(dual-beam receiving) , .

, 7 , 1 .

, 1 , (110) (1a 1h) , 1 A$_1$

n P 1 B

$_1$ n+1 Q ,

A$_1$ B$_1$ X(A$_1$+B$_1$)

2 , 1 (1a 1h) , 2 A$_2$

n P 2 B$_2$

n+1 Q ,

A$_2$ B$_2$ Y(A$_2$+B$_2$)

. 1 , , X(A$_1$+B$_1$) Y(A$_2$+B$_2$) X'(A$_1$+B$_1$) Y'(A$_2$+

B$_2$) A$_1$, A$_2$ B$_1$, B$_2$ n n+1

. 1 (A$_1$ B$_1$ A$_2$

B$_2$) [X(A$_1$+B$_1$) Y(A$_2$+B$_2$)] ,

. .

, SNR . ,

L SNR .

< 2 >

, 8 , 2 .

2 1 , P, Q

. , 1

, 1 , (110) (1a 1h) , 1 A$_1$

n P , (1a 1h)

1 B$_1$, n

Q A$_1$ B$_1$

X(A$_1$+B$_1$) .

2 , 1 (1a 1h) , 2 A$_2$

n P 2 B$_2$

n Q

, A$_2$ B$_2$ Y(A$_2$+B$_2$)

. 2 , 1 ,

.

, , ,

, .

, 2 1 1/M

SNR .

SNR

M = 2

M > 2

2

M = 3

1 (1D)

2 ( )

2D

2D

1.75D , 1.75D

1.5D .

1.

M - M -

M ,

M M

M ,

M

2.

1 ,

M .

3.

1 ,

M .

4.

5.

1 ,

.

6.

1 , ,

M

M ,

M

M .

7.

6 , ,

M M ,

M M

.

8.

6 , ,

M

M

.

9.

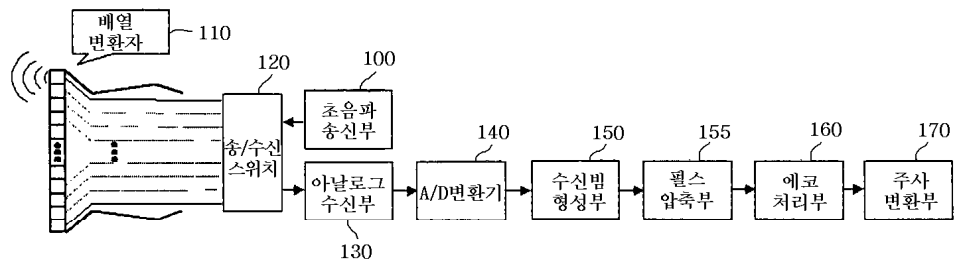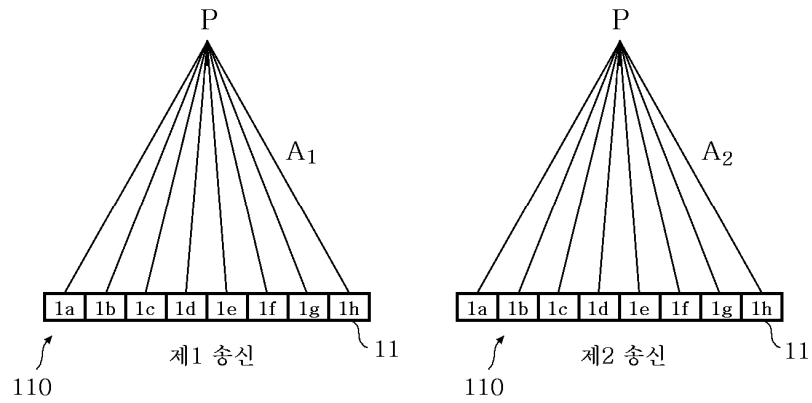1   ,   M   L   (biphase sequ
ences)   ,

$A_i = [a_{i1}, a_{i2}, \cdots, a_{iL}], \quad i=1,2,\cdots,M$

a $_{i1}$, a $_{i2}$, ..., a $_{iL}$ - 1, 0, 1   ,
                                                    (complementary)   ,

$x(k) = \sum_{i=1}^{M} \sum_{l=1}^{L-k} a_{il} \, a^*_{i,l+k} = ML\delta(k), \quad k=0,1,\cdots,L-1$
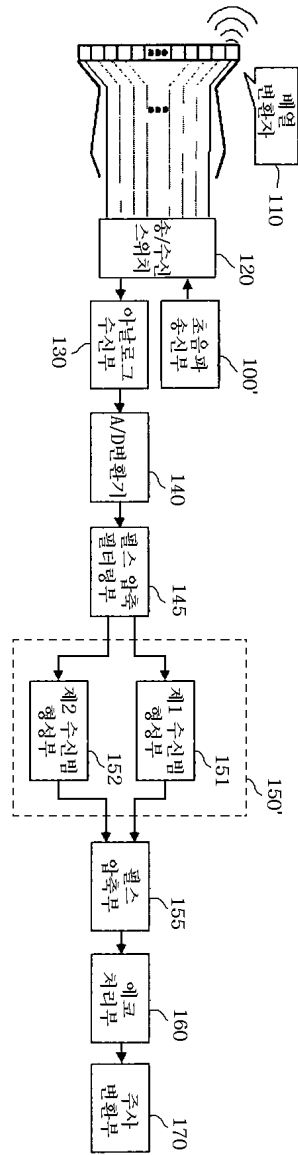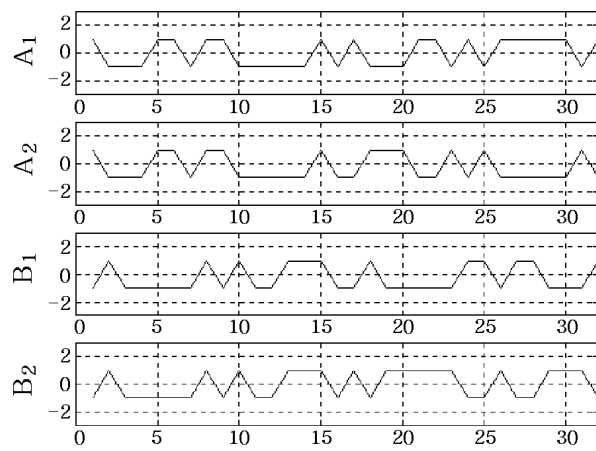
                    (k)   (dirac function)   .

10.

                    M   -   ,   M   -
            ,
            M   ,   ,
M   M
    ,
        M   ,
                                    M
                                                    ,
                        .

11.
10   ,   ,
        M   .

12.
10   ,   ,
        M   .

13.

14.
10   ,
                        .

15.
10   ,   ,
                                    M   M   ,
        M   M
                        .

16.
15   ,   ,
        M   M   ,
        M   M
                        .

17.
15   ,   ,
        M   ,
                                    M
                        .

18.
10   ,   M   L   ,
$A_i = [a_{i1}, a_{i2}, \cdots, a_{iL}], \quad i=1,2,\cdots,M$

            a $_{i1}$, a $_{i2}$, ..., a $_{iL}$ - 1, 0, 1   ,

$x(k) = \sum_{i=1}^{M} \sum_{l=1}^{L-k} a_{il} \, a^*_{i,l+k} = ML\delta(k), \quad k=0,1,\cdots,L-1$

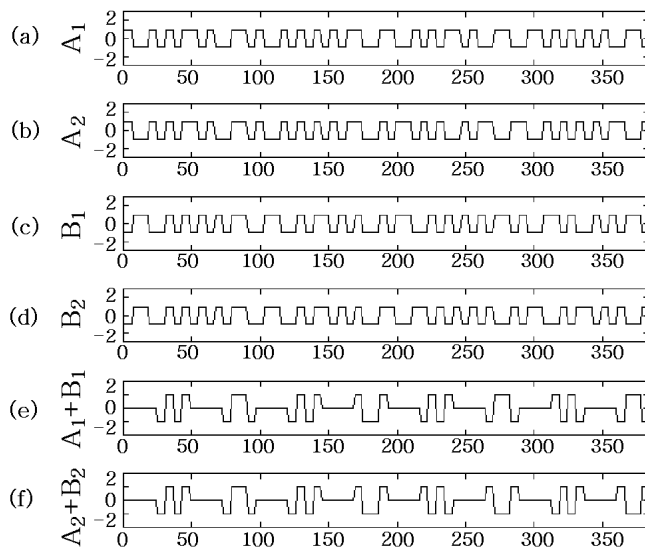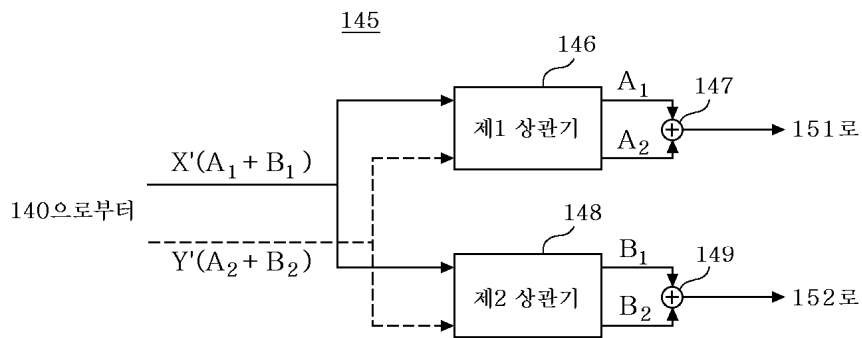   (k)   .

1

2

제1 송신

제2 송신

3

도 3

배열 변환자 — 110

송/수신 스위치 — 120

조음파 송신부 — 100'

아날로그 수신부 — 130

A/D변환기 — 140

펄스 압축 필터링부 — 145

제1 수신빔 형성부 — 151

제2 수신빔 형성부 — 152

150'

펄스 압축부 — 155

에코 처리부 — 160

주사 변환부 — 170

4

도 4

5

6

7

8

제1 송신

110

제2 송신

110
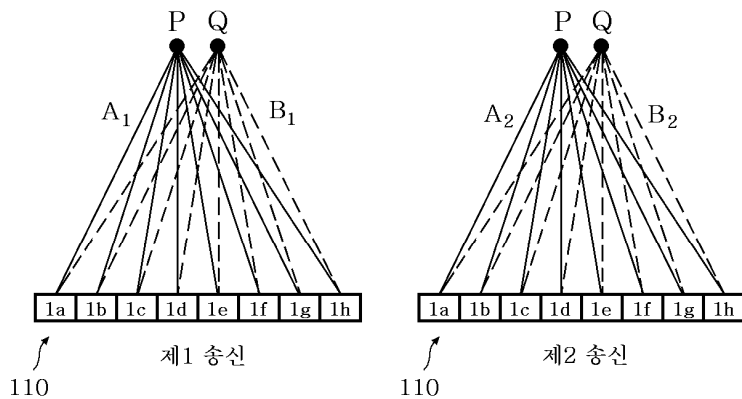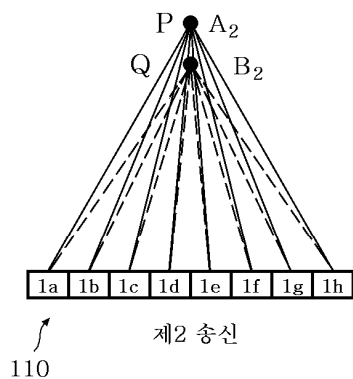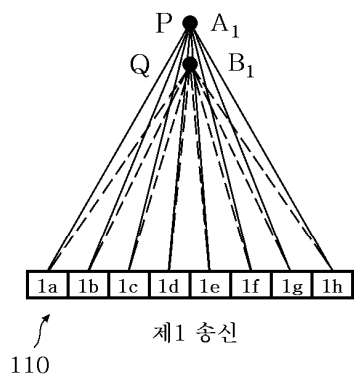
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摘要(译)

本发明提供了超声成像设备和方法，用于发送包括Golay码的正交的超声信号，作为与超声成像设备和方法有关的发明，用于使用具有正交特性的一组具有正交特性作为超声波发送和接收信号的同时，不同的代码。与使用本发明的传统方法相比，Golay码的正交和多码可以更好地预期优秀的SNR是Golay码。同时，与一般脉冲技术相比，帧速率不会降低。超音速发送，Golay码，正交特性，脉冲压缩，相关器。