

(19) (KR)
(12) (A)

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(21) 10-2003-0047453
(22) 2003 07 11

(71) 134
가 161

(72) 307 304

701-1608

118-1404

3 344-139

2 102-403

804-1504

3 310-1004

177-153

(74)

:

(54)

가 1 1 1 , G.723.1 가 - , 5
2
, 1 - 가 2
가 ,

2

1 G.723.1

2 G.723.1

3 2 G.723.1

ITU-T G.723.1 VoIP(Voice over Internet Protocol) ITU-T G.723.1
5.3 kbps 6.3 kbps 가
CELP (Code-Excited Linear Prediction)

가 CELP (analysis-by-synthesis) 가
5 G.723.1

1 G.723.1
5 (101), LPC(Linear Predictive Coding) (102), 가 (103) (10
4)

1 , 5 (101) '0' (101)
. 5 , 5 (101) 1

$$\frac{1}{P5(z)} = \frac{1}{1 - \sum_{i=2}^2 G_i z^{(-L-i)}}$$

, G_i , L .
 LPC (102) 2 가 , 5 (101)

$$\frac{1}{A(z)} = \frac{1}{1 - \sum_{j=1}^{10} a_j z^{-j}}$$

가 (103) 3 가 , LPC (102)

$$W(z) = \frac{1 - \sum_{j=1}^{10} a_j z^{-j} r_1^j}{1 - \sum_{j=1}^{10} a_j z^{-j} r_2^j}$$

, a_j LPC , r_1 r_2 가 .
 , (104) 가 . G.723.1 4 - -1
 , 0, 1 , -1,
 0, 1, 2 가 . 5 (101)
 가 가 , 4 $t(n)$

$$\begin{aligned} MSE_{ACB} &= \sum_{n=0}^{N-1} \{ (t(n) - \sum_{i=2}^2 G_i \hat{t}(n-l+i))^2 \} \\ &= \sum_{n=0}^{N-1} t^2(n) - 2 \sum_{i=2}^2 (G_i \sum_{n=0}^{N-1} t(n) \hat{t}(n-l+i)) \\ &\quad + \sum_{i=2}^2 \sum_{j=2}^2 G_i G_j (\sum_{n=0}^{N-1} \hat{t}(n-l+i) \hat{t}(n-l+j)) \\ &= \sum_{n=0}^{N-1} t^2(n) - 2 \{ \sum_{i=2}^2 (G_i \sum_{n=0}^{N-1} t(n) \hat{t}(n-l+i)) \} \\ &\quad - \frac{1}{2} \sum_{i=2}^2 G_i^2 (\sum_{n=0}^{N-1} \hat{t}^2(n-l+i)) \\ &\quad - \sum_{i=1}^2 \sum_{j=2}^{i-1} G_i G_j (\sum_{n=0}^{N-1} \hat{t}(n-l+i) \hat{t}(n-l+i)) \end{aligned}$$

, N - , l - ,
 - . 4 5 . G_i 5

$$\begin{aligned}
C_{ACB} &= \sum_{i=-2}^2 (G_i \sum_{n=0}^{N-1} t(n) \hat{t}(n-l+i)) \\
&\quad - \frac{1}{2} \sum_{i=-2}^2 G_i^2 (\sum_{n=0}^{N-1} \hat{t}^2(n-l+i)) \\
&\quad - \sum_{i=-1}^2 \sum_{j=-2}^{i-1} G_i G_j (\sum_{n=0}^{N-1} \hat{t}(n-l+i) \hat{t}(n-l+j))
\end{aligned}$$

G.723.1, G_i 5 ($G_i \cdot G_j$ 10 ($i=-2, -1, 0, 1, 2$)
 $i=-1, 0, 1, 2$ $j=-2, \dots, i-1$ 5 10가 5 $G_i \cdot G_j$ 10 (5
(6.3 kbps) 85 170
(5.3 kbps) 170
3 4
, 30ms G.723.1 2 170 85
14 (= 3+4+3+4) 5 (criterion)

G.723.1

가

, G.723.1 가 - 1 1 1
2, 5 2, 1 -
2
, G.723.1 (a) , (a) -
[$\sum_{n=0}^{N-1} (t(n) \hat{t}(n-l))$]²
 $\sum_{n=0}^{N-1} \hat{t}^2(n-l)$ (b) , (b)
가 - , (c) , (c)
(d) , (d)

$$\begin{aligned}
&\sum_{i=-2}^2 (G_i \sum_{n=0}^{N-1} t(n) \hat{t}(n-L_{clp}+i)) \\
&\quad - \frac{1}{2} \sum_{i=-2}^2 G_i^2 (\sum_{n=0}^{N-1} \hat{t}^2(n-L_{clp}+i)) \\
&\quad - \sum_{i=-1}^2 \sum_{j=-2}^{i-1} G_i G_j (\sum_{n=0}^{N-1} \hat{t}(n-L_{clp}+i) \hat{t}(n-L_{clp}+j))
\end{aligned}$$

(f) (e) (e) .

2 G.723.1

4) 1 (208) 2 (210) , 5 (220) (201), LPC (205), LPC (202), 가 (206), 가 (203) (207) (20

2 , 1 (210) 1 (201) 6 (t) 가 .

$$\frac{1}{P1(z)} = \frac{1}{1 - g \cdot z^{-L}}$$

o-input), , g , L . 1 (201) '0' (zer

가 LPC (203) (202) 1 (201) (202) (204) 가 ,

2 (220) 1 (210) - 1 (201) 5 (205) 1 (210) 5 (206) 5 (205) 가 LPC (20

7) LPC (206) 5 (205) (208) 가 ,

1 (201) 7 1 (201)

$$\begin{aligned} MSE^I_{ACB} &= \sum_{n=0}^{N-1} \{ (t(n) - \hat{g}t(n-l))^2 \} \\ &= \sum_{n=0}^{N-1} t^2(n) - 2g \sum_{n=0}^{N-1} t(n)\hat{t}(n-l) + g^2 \sum_{n=0}^{N-1} \hat{t}^2(n-l) \end{aligned}$$

8 , / - , g 1 7 -

3 4 1 9

$$C^I_{ACB} = \frac{[\sum_{n=0}^{N-1} (\hat{t}(n) \hat{t}(n-L))]^2}{\sum_{n=0}^{N-1} \hat{t}^2(n-L)} \quad 8$$

$$g = \frac{\sum_{n=0}^{N-1} (\hat{t}(n) \hat{t}(n-L_{clp}))}{\sum_{n=0}^{N-1} \hat{t}^2(n-L_{clp})} \quad 9$$

, L_{clp} 8 - .
 , 1 - - , 9
 1 . 5 170 85 1/2
 g 9
 . , 10 .

$$C^I_{gain} = \sum_{i=2}^2 (G_i \sum_{n=0}^{N-1} \hat{t}(n) \hat{t}(n-L_{clp}+i)) - \frac{1}{2} \sum_{i=2}^2 G_i^2 (\sum_{n=0}^{N-1} \hat{t}^2(n-L_{clp}+i)) - \sum_{i=1}^2 \sum_{j=2}^{i-1} G_i G_j (\sum_{n=0}^{N-1} \hat{t}(n-L_{clp}+i) \hat{t}(n-L_{clp}+j)) \quad 10$$

5 10 N_{ACB} (=170)
 - 3 4 14
 $\frac{1}{2} N_{ACB}$ (=85)
 (210) - 1 G.723.1 4 1
 . , 1/7 (= (4 / 14) * (1 / 2))
 .
 3 2 G.723.1 .
 2 3 , - (L_{olp}) - - (L_{clp})
 - [L_{olp} -1, L_{olp} +1] ((301) . - [L_{clp} -1, L_{clp} +2]
 ()
 301 - - (204)
 8 (302 305).
 - 302 305 , 8 가 -
 (306).
 306 - 1 (201) (307).

307
) . 85 , 5 (205) 1 (201) 170 (311

315 (208) 311 85 10 (312).

$$85 \quad , \quad 5 \quad \quad \quad 312 \quad 315 \quad , \quad 10 \quad \quad \quad (205) \quad (316) .$$

G.723.1, 1, 5

170 5 1 85

가 . 가 ROM, RAM, CD-ROM, , 가 . 가 , 가 .

가 . 가

가

(57)

1. G.723.1 , 1 ;

1, 5
2

LPC

가 ;

가

-

.

3.

2 ,

1

1

-

.

[1]

$$\begin{aligned}
 MSE'_{ACB} &= \sum_{n=0}^{N-1} \{ (t(n) - g\hat{t}(n-l))^2 \} \\
 &= \sum_{n=0}^{N-1} t^2(n) - 2g \sum_{n=0}^{N-1} t(n)\hat{t}(n-l) + g^2 \sum_{n=0}^{N-1} \hat{t}^2(n-l)
 \end{aligned}$$

(, l - , N , g 1)

4.

3 , 1 -

2

.

[2]

$$\frac{[\sum_{n=0}^{N-1} (t(n)\hat{t}(n-l))]^2}{\sum_{n=0}^{N-1} \hat{t}^2(n-l)}$$

(, N , l -)

5.

4 , 1 1

3

.

[3]

$$g = \frac{\sum_{n=0}^{N-1} (t(n)\hat{t}(n-L_{clp}))}{\sum_{n=0}^{N-1} \hat{t}^2(n-L_{clp})}$$

(, L_{clp} 2 -)

6.

1 , 2

1

-

-

5 ;

5 LPC ;
 LPC 가 ;
 가 5 .

7.
 6 ,
 2 .

$$\begin{aligned} & \sum_{i=-2}^2 (G_i \sum_{n=0}^{N-1} t(n) \hat{t}(n-L_{clp}+i)) \\ & - \frac{1}{2} \sum_{i=-2}^2 G_i^2 (\sum_{n=0}^{N-1} \hat{t}^2(n-L_{clp}+i)) \\ & - \sum_{i=-1}^2 \sum_{j=-2}^{i-1} G_i G_j (\sum_{n=0}^{N-1} \hat{t}(n-L_{clp}+i) \hat{t}(n-L_{clp}+j)) \end{aligned}$$

(, L_{clp}) (c) - , i j , G_i

8.
 G.723.1 ,

(a) - ;
 (b) (a) - ,

$$\frac{[\sum_{n=0}^{N-1} (t(n) \hat{t}(n-l))]^2}{\sum_{n=0}^{N-1} \hat{t}^2(n-l)}$$

(, N , l - , g 1)

(c) (b) 가 - , ;
 (d) (c) , ;
 (e) (d) ;

$$\begin{aligned} & \sum_{i=-2}^2 (G_i \sum_{n=0}^{N-1} t(n) \hat{t}(n-L_{clp}+i)) \\ & - \frac{1}{2} \sum_{i=-2}^2 G_i^2 (\sum_{n=0}^{N-1} \hat{t}^2(n-L_{clp}+i)) \\ & - \sum_{i=-1}^2 \sum_{j=-2}^{i-1} G_i G_j (\sum_{n=0}^{N-1} \hat{t}(n-L_{clp}+i) \hat{t}(n-L_{clp}+j)) \end{aligned}$$

(, L_{clp}) (c) - , i j , G_i

(f) (e) .

9. 8 , (a) - 3 - 4 - .

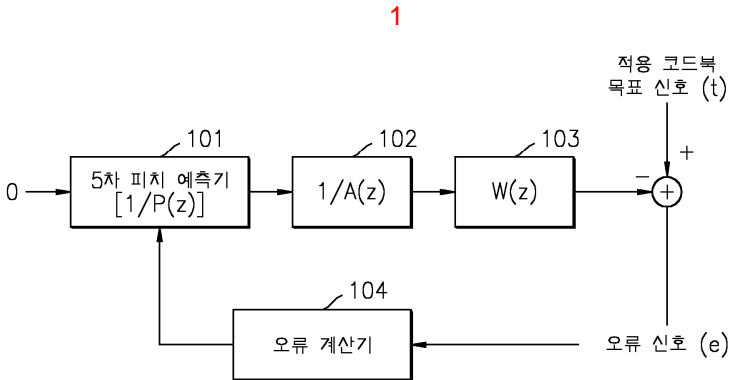
10. 8 , (c) .

$$g = \frac{\sum_{n=0}^{N-1} (t(n) \hat{t}(n-L_{clp}))}{\sum_{n=0}^{N-1} \hat{t}^2(n-L_{clp})}$$

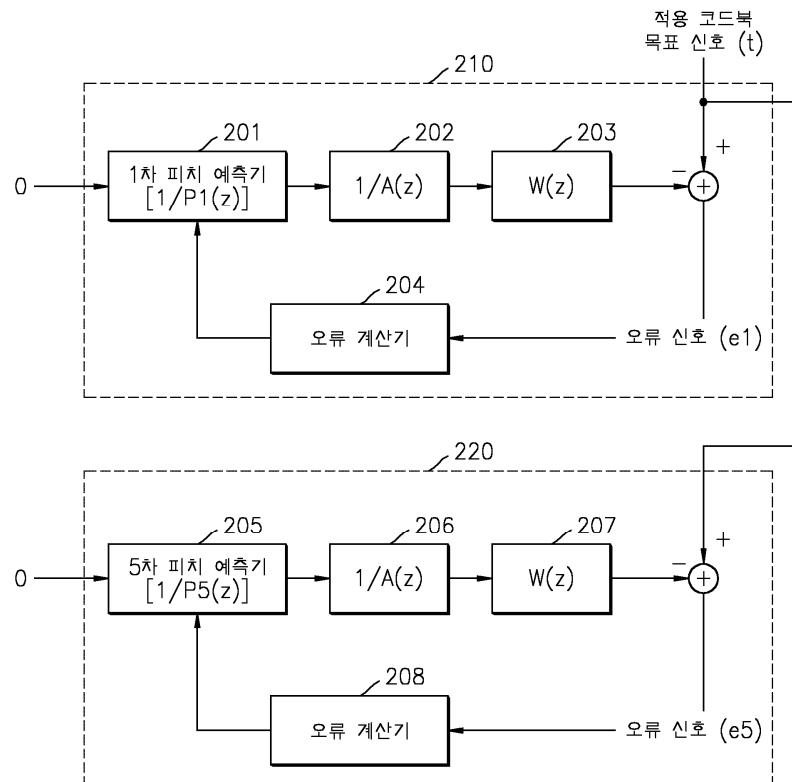
(, L_{clp} 2 -)

11. 8 , (d) 85 .

12. 8 가 .



2



3

