

CLAIMS

1. A method for channel decoding using a Low-Density Parity-Check (LDPC) code, the method comprising:

5 demodulating a signal transmitted from a transmitter;
determining position information of the punctured parity bits by estimating information about a predetermined order of parity bit sets to be punctured and the number of parity bit sets; and

10 decoding data using the position information of the punctured parity bits,
wherein determining position of punctured parity bits comprises:
determining a number of parity bits to be punctured;
determining a number of parity bit sets to be punctured based on the determined number of parity bits to be punctured; and

15 acquiring a predetermined order of parity bit sets,
wherein the predetermined order of parity bit sets is 6, 4, 18, 9, 13, 8, 15, 20, 5, 17, 2, 24, 10, 22, 12, 3, 16, 23, 1, 14, 0, 21, 19, 7, 11, when a codeword length is 16200.

2. The method of claim 1, further comprising:
20 determining that puncturing parity bits additionally is punctured, when the number of the parity bits for puncturing is not a multiple of the length of the one parity bit sets.

3. The method of claim 1, further comprising:
receiving remaining bits, except for the punctured bits.

25 4. The method of claim 1, wherein the number of parity bit sets is being determined by below equation

$$A = \left\lfloor \frac{N_p}{M_l} \right\rfloor,$$

30 where A denotes the number of parity bit sets to be punctured, N_p denotes the number of parity bits to be punctured, M_l denotes the length of one parity bit sets.

5. The method of claim 4, wherein the parity bit sets are formed by below equation

$$P_j = \{p_k | j \equiv k \bmod q, 0 \leq k < N_l - K_l\},$$

35 where P_j denotes the j^{th} parity bit set, N_l denotes a length of a LDPC codeword, K_l denotes a length of an information word, M_l denotes the length of one parity bit sets, q is a value satisfying $q = (N_l - K_l) / M_l$, where K_l / M_l is an integer, and $0 \leq j < q$.

6. The method of claim 5, wherein:

determining that all of parity bits corresponding to A parity bit sets $P_{\pi(0)}, P_{\pi(1)}, \dots, P_{\pi(A-1)}$ are punctured; and

determining that additionally $(N_p - 360 A)$ parity bits among the parity bits corresponding to $P_{\pi(A)}$ are punctured.

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7. A method for channel decoding using a Low-Density Parity-Check (LDPC) code, the method comprising:

demodulating a signal transmitted from a transmitter;

10 determining position information of the punctured parity bits by estimating information about a predetermined order of parity bit sets to be punctured and the number of parity bit sets; and

decoding data using the position information of the punctured parity bits,

wherein determining position information of punctured parity bits comprises:

determining a number of parity bits to be punctured;

15 determining a number of parity bit sets to be punctured based on the determined number of parity bits to be punctured; and

acquiring a predetermined order of parity bit sets,

20 wherein the predetermined order of parity bit sets is 27, 13, 29, 32, 5, 0, 11, 21, 33, 20, 25, 28, 18, 35, 8, 3, 9, 31, 22, 24, 7, 14, 17, 4, 2, 26, 16, 34, 19, 10, 12, 23, 1, 6, 30, 15, when a codeword length is 16200.

8. The method of claim 7, further comprising:

determining that puncturing parity bits additionally is punctured, when the number of the parity bits for puncturing is not a multiple of the length of the one parity bit sets.

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9. The method of claim 7, further comprising:

receiving remaining bits, except for the punctured bits.

10. The method of claim 7, wherein the number of parity bit sets is being determined by below equation

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$$A = \left\lfloor \frac{N_p}{M_1} \right\rfloor,$$

where A denotes the number of parity bit sets to be punctured, N_p denotes the number of parity bits to be punctured, M_1 denotes the length of one parity bit sets.

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11. The method of claim 10, wherein the parity bit sets are formed by below equation

$$P_j = \{p_k \mid j \equiv k \bmod q, 0 \leq k < N_1 - K_1\},$$

where P_j denotes the j^{th} parity bit set, N_1 denotes a length of a LDPC codeword, K_1

denotes a length of an information word, M_1 denotes the length of one parity bit sets, q is a value satisfying $q = (N_1 - K_1) / M_1$, where K_1/M_1 is an integer, and $0 \leq j < q$.

12. The method of claim 11, wherein:
- 5 determining that all of parity bits corresponding to A parity bit sets $P_{\pi(0)}, P_{\pi(1)}, \dots, P_{\pi(A-1)}$ are punctured; and
- determining that additionally $(N_p - 360 A)$ parity bits among the parity bits corresponding to $P_{\pi(A)}$ are punctured.
- 10 13. An apparatus for channel decoding using a Low-Density Parity-Check (LDPC) code, the apparatus comprising:
- a demodulator for demodulating a signal transmitted from a transmitter;
- a puncturing pattern decision unit for determining position information of the punctured parity bits by estimating information about a predetermined order of parity bit sets to
- 15 be punctured and the number of parity bit sets; and
- a decoder for decoding data using the position information of the punctured parity bits, wherein determining position information of punctured parity bits comprises:
- determining a number of parity bits to be punctured;
- determining a number of parity bit sets to be punctured based on the
- 20 determined number of parity bits to be punctured; and
- acquiring a predetermined order of parity bit sets,
- wherein the predetermined order of parity bit sets is 6, 4, 18, 9, 13, 8, 15, 20, 5, 17, 2, 24, 10, 22, 12, 3, 16, 23, 1, 14, 0, 21, 19, 7, 11, when a codeword length is 16200.
- 25 14. The apparatus of claim 13, wherein the puncturing pattern decision unit determines that puncturing parity bits additionally is punctured, when the number of the parity bits for puncturing is not a multiple of the length of the one parity bit sets.
15. The apparatus of claim 13, further comprising:
- 30 a receiver for receiving remaining bits, except for the punctured bits.
16. The apparatus of claim 13, wherein the number of parity bit sets is being determined by below equation

$$A = \left\lceil \frac{N_p}{M_1} \right\rceil,$$

- 35 where A denotes the number of parity bit sets to be punctured, N_p denotes the number of parity bits to be punctured, M_1 denotes the length of one parity bit sets.

17. The apparatus of claim 16, wherein the parity bit sets are formed by below equation

$$P_j = \{p_k \mid j \equiv k \bmod q, 0 \leq k < N_I - K_I\},$$

where P_j denotes the j^{th} parity bit set, N_I denotes a length of a LDPC codeword, K_I denotes a length of an information word, M_I denotes the length of one parity bit sets, q is a value satisfying $q = (N_I - K_I) / M_I$, where K_I/M_I is an integer, and $0 \leq j < q$.

18. The apparatus of claim 17, wherein the puncturing pattern decision unit determines that all of parity bits corresponding to A parity bit sets $P_{\pi(0)}, P_{\pi(1)}, \dots, P_{\pi(A-1)}$ are punctured, and determines that additionally $(N_p - 360 A)$ parity bits among the parity bits corresponding to $P_{\pi(A)}$ are punctured.

19. An apparatus for channel decoding using a Low-Density Parity-Check (LDPC) code, the apparatus comprising:

a demodulator for demodulating a signal transmitted from a transmitter;

15 a puncturing pattern decision unit for determining position information of the punctured parity bits by estimating information about a predetermined order of parity bit sets to be punctured and the number of parity bit sets; and

a decoder for decoding data using the position information of the punctured parity bits, wherein determining position information of punctured parity bits comprises:

20 determining a number of parity bits to be punctured;

determining a number of parity bit sets to be punctured based on the determined number of parity bits to be punctured; and

acquiring a predetermined order of parity bit sets,

25 wherein the predetermined order of parity bit sets is 27, 13, 29, 32, 5, 0, 11, 21, 33, 20, 25, 28, 18, 35, 8, 3, 9, 31, 22, 24, 7, 14, 17, 4, 2, 26, 16, 34, 19, 10, 12, 23, 1, 6, 30, 15, when a codeword length is 16200.

20. The apparatus of claim 19, wherein the puncturing pattern decision unit determines that puncturing parity bits additionally is punctured, when the number of the parity bits for puncturing is not a multiple of the length of the one parity bit sets.

21. The apparatus of claim 19, further comprising:

a receiver for receiving remaining bits, except for the punctured bits.

35 22. The apparatus of claim 19, wherein the number of parity bit sets is being determined by below equation

$$A = \left\lfloor \frac{N_p}{M_I} \right\rfloor,$$

where A denotes the number of parity bit sets to be punctured, N_p denotes the number of parity bits to be punctured, M_l denotes the length of one parity bit sets.

23. The apparatus of claim 22, wherein the parity bit sets are formed by below equation

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$$P_j = \{p_k \mid j \equiv k \bmod q, 0 \leq k < N_l - K_l\},$$

where P_j denotes the j^{th} parity bit set, N_l denotes a length of a LDPC codeword, K_l denotes a length of an information word, M_l denotes the length of one parity bit sets, q is a value satisfying $q = (N_l - K_l) / M_l$, where K_l / M_l is an integer, and $0 \leq j < q$.

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24. The apparatus of claim 23, wherein the puncturing pattern decision unit determines that all of parity bits corresponding to A parity bit sets $P_{\pi(0)}, P_{\pi(1)}, \dots, P_{\pi(A-1)}$ are punctured, and determines that additionally $(N_p - 360 A)$ parity bits among the parity bits corresponding to $P_{\pi(A)}$ are punctured.

CLAIMS

1. A method for channel decoding using a low-density parity check (LDPC) code, the method comprising:
 - 5 demodulating a signal transmitted from a transmitter;
 - determining a number of punctured parity bits;
 - determining a number of punctured parity bit sets based on the determined number of the punctured parity bits;
 - acquiring a predetermined order of punctured parity bit sets;
 - 10 determining position information of the punctured parity bits based on the predetermined order; and
 - decoding data using the position information of the punctured parity bits, wherein the predetermined order of parity bit sets to be punctured is defined by $P_{\pi(0)}, P_{\pi(1)}, \dots, P_{\pi(A-1)}$ where $\pi(0), \pi(1), \dots, \pi(A-1) = 6, 4, 18, 9, 13, 8, 15, 20, 5, 17, 2,$
15 $24, 10, 22, 12, 3, 16, 23, 1, 14, 0, 21, 19, 7, 11$, when a codeword length is 16200,
wherein the punctured parity bit sets are formed by below equation
$$P_j = \{p_k \mid j = k \bmod q, 0 \leq k < N_1 - K_1\},$$
where P_j denotes the j^{th} parity bit set, N_1 denotes the codeword length, K_1 denotes a length of an information word, M_1 denotes the length of one parity bit sets, q is a value satisfying $q = (N_1 - K_1) / M_1$, where K_1/M_1 is an integer, and $0 \leq j < q$.
2. The method of claim 1, further comprising:
 - determining that additional parity bits is punctured, when the number of the punctured parity bits is not a multiple of the length of one parity bit set.
- 25 3. The method of claim 1, further comprising:
 - receiving remaining bits, except for the punctured parity bits.
4. The method of claim 1, wherein the number of the punctured parity bit sets is
$$A = \left\lfloor \frac{N_p}{M_1} \right\rfloor,$$
30 defined by
where A denotes the number of the punctured parity bit sets, N_p denotes the number of the punctured parity bits, M_1 denotes the length of one parity bit set.
5. The method of claim 1, wherein:
 - 35 determining that all of the parity bits corresponding to a number A of the parity bit sets $P_{\pi(0)}, P_{\pi(1)}, \dots, P_{\pi(A-1)}$ are punctured; and
 - determining that additional $(N_p - 360 A)$ parity bits among the parity bits corresponding to the parity bit set $P_{\pi(A)}$ are punctured.

6. A method for channel decoding using a low-density paritycheck (LDPC) code, the method comprising:
- demodulating a signal transmitted from a transmitter;
- 5 determining a number of punctured parity bits;
- determining a number of punctured parity bit sets based on the determined number of the punctured parity bits;
- acquiring a predetermined order of punctured parity bit sets;
- determining position information of the punctured parity bits based on the
- 10 predetermined order; and
- decoding data using the position information of the punctured parity bits, wherein the predetermined order of parity bit sets to be punctured is defined by $P_{\pi(0)}, P_{\pi(1)}, \dots, P_{\pi(A-1)}$ where $\pi(0), \pi(1), \dots, \pi(A-1) = 27, 13, 29, 32, 5, 0, 11, 21, 33, 20, 25, 28, 18, 35, 8, 3, 9, 31, 22, 24, 7, 14, 17, 4, 2, 26, 16, 34, 19, 10, 12, 23, 1, 6, 30, 15,$
- 15 when a codeword length is 16200,

wherein the punctured parity bit sets are formed by below equation

$$P_j = \{p_k \mid j \equiv k \bmod q, 0 \leq k < N_1 - K_1\},$$

- where P_j denotes the j^{th} parity bit set, N_1 denotes the codeword length, K_1 denotes a length of an information word, M_1 denotes the length of one parity bit sets, q
- 20 is a value satisfying $q = (N_1 - K_1) / M_1$, where K_1/M_1 is an integer, and $0 \leq j < q$.

7. The method of claim 6, further comprising:
- determining that puncturing parity bits additionally is punctured, when the number of the parity bits for puncturing is not a multiple of the length of the one parity
- 25 bit sets.

8. The method of claim 6, further comprising:
- receiving remaining bits, except for the punctured bits.

- 30 9. The method of claim 6, wherein the number of parity bit sets is being determined by below equation

$$A = \left\lceil \frac{N_p}{M_1} \right\rceil,$$

- where A denotes the number of the punctured parity bit sets, N_p denotes the number of the punctured parity bits, M_1 denotes the length of one parity bit set.
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10. The method of claim 6, wherein:
- determining that all of parity bits corresponding to A parity bit sets $P_{\pi(0)}, P_{\pi(1)}, \dots, P_{\pi(A-1)}$ are punctured; and

determining that additionally $(N_p - 360 A)$ parity bits among the parity bits corresponding to $P_{\pi(A)}$ are punctured.

11. An apparatus for channel decoding using a low-density parity-check (LDPC) code, the apparatus comprising:
- 5 a demodulator for demodulating a signal transmitted from a transmitter;
- a puncturing pattern decision unit for determining a number of punctured parity bits, determining a number of punctured parity bit sets based on the determined number of the punctured parity bits, acquiring a predetermined order of punctured
- 10 parity bit sets; and
- a decoder for decoding data using the position information of the punctured parity bits,
- wherein the predetermined order of parity bit sets to be punctured is defined by $P_{\pi(0)}, P_{\pi(1)}, \dots, P_{\pi(A-1)}$ where $\pi(0), \pi(1), \dots, \pi(A-1) = 6, 4, 18, 9, 13, 8, 15, 20, 5, 17, 2,$
- 15 $24, 10, 22, 12, 3, 16, 23, 1, 14, 0, 21, 19, 7, 11$, when a codeword length is 16200,
- wherein the punctured parity bit sets are formed by below equation
- $$P_j = \{p_k \mid j \equiv k \bmod q, 0 \leq k < N_1 - K_1\},$$
- where P_j denotes the j^{th} parity bit set, N_1 denotes the codeword length, K_1 denotes a length of an information word, M_1 denotes the length of one parity bit sets, q
- 20 is a value satisfying $q = (N_1 - K_1) / M_1$, where K_1/M_1 is an integer, and $0 \leq j < q$.

12. The apparatus of claim 11, wherein the puncturing pattern decision unit determines that additional parity bits is punctured, when the number of the punctured parity bits is not a multiple of the length of one parity bit set.

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13. The apparatus of claim 11, further comprising:
- a receiver for receiving remaining bits, except for the punctured parity bits.
14. The apparatus of claim 11, wherein the number of punctured parity bit sets is
- 30 defined by

$$A = \left\lfloor \frac{N_p}{M_1} \right\rfloor,$$

where A denotes the number of the punctured parity bit sets, N_p denotes the number of punctured parity bits, M_1 denotes the length of one parity bit set.

- 35 15. The apparatus of claim 11, wherein the puncturing pattern decision unit determines that all of parity bits corresponding to A parity bit sets $P_{\pi(0)}, P_{\pi(1)}, \dots, P_{\pi(A-1)}$ are punctured, and determines that additionally $(N_p - 360 A)$ parity bits among the parity bits corresponding to $P_{\pi(A)}$ are punctured.

16. An apparatus for channel decoding using a low-density parity check (LDPC) code, the apparatus comprising:

a demodulator for demodulating a signal transmitted from a transmitter;

5 a puncturing pattern decision unit for determining a number of punctured parity bits, determining a number of punctured parity bit sets based on the determined number of the punctured parity bits, acquiring a predetermined order of punctured parity bit sets; and

10 a decoder for decoding data using the position information of the punctured parity bits,

wherein the predetermined order of parity bit sets to be punctured is defined by $P_{\pi(0)}, P_{\pi(1)}, \dots, P_{\pi(A-1)}$ where $\pi(0), \pi(1), \dots, \pi(A-1) = 27, 13, 29, 32, 5, 0, 11, 21, 33, 20, 25, 28, 18, 35, 8, 3, 9, 31, 22, 24, 7, 14, 17, 4, 2, 26, 16, 34, 19, 10, 12, 23, 1, 6, 30, 15$, when a codeword length is 16200,

15 wherein the punctured parity bit sets are formed by below equation

$$P_j = \{p_k \mid j \equiv k \bmod q, 0 \leq k < N_1 - K_1\},$$

where P_j denotes the j^{th} parity bit set, N_1 denotes the codeword length, K_1 denotes a length of an information word, M_1 denotes the length of one parity bit sets, q is a value satisfying $q = (N_1 - K_1) / M_1$, where K_1/M_1 is an integer, and $0 \leq j < q$.

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17. The apparatus of claim 16, wherein the puncturing pattern decision unit determines that additional parity bits additionally is punctured, when the number of the punctured parity bits is not a multiple of the length of one parity bit set.

25 18. The apparatus of claim 16, further comprising:

a receiver for receiving remaining bits, except for the punctured parity bits.

19. The apparatus of claim 16, wherein the number of the punctured parity bit

sets is defined by
$$A = \left\lfloor \frac{N_p}{M_1} \right\rfloor,$$

30 where A denotes the number of the punctured parity bit sets, N_p denotes the number of the punctured parity bits, M_1 denotes the length of one parity bit set.

20. The apparatus of claim 16, wherein the puncturing pattern decision unit determines that all of parity bits corresponding to A parity bit sets $P_{\pi(0)}, P_{\pi(1)}, \dots, P_{\pi(A-1)}$ are punctured, and determines that additionally $(N_p - 360 A)$ parity bits among the
35 parity bits corresponding to $P_{\pi(A)}$ are punctured.