CLAIMS

1. A method of encoding information, by a transmitting device using a parity check matrix of a low-density parity-check code, for transmission over a communication channel, the method comprising:

determining, by the transmitting device, the parity check matrix comprising a plurality of submatrices that each have dimension $Z \times Z$ for a non-negative integer Z, wherein among the plurality of submatrices:

for $m = 0$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 1, 2, 3, 5, 6, 9, 10, 11, 12, 13, 15, 16, 18, 19, 20, 21, 22, 23$ is obtained based on a respective value according to:

n	**value**
0	223
1	16
2	94
3	91
5	74
6	10
9	0
10	205
11	216
12	21
13	215
15	14
16	70
18	141
19	198
20	104
21	81
22	1
23	0

for $m = 1$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of

$n = 0, 2, 3, 4, 5, 7, 8, 9, 11, 12, 14, 15, 16, 17, 19, 21, 22, 23, 24$ is obtained based on a respective value according to:

n	**value**
0	141
2	45
3	151
4	46
5	119
7	157
8	133
9	87
11	206
12	93
14	79
15	9
16	118
17	194
19	31
21	187
22	0
23	0
24	0

for $m = 2$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = \{0, 1, 2, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 17, 18, 19, 20, 24, 25\}$ is obtained based on a respective value according to:

n	**value**
0	207
1	203
2	31
4	176
5	180
6	186
7	95
8	153

9	177
10	70
13	77
14	214
15	77
17	198
18	117
19	223
20	90
24	0
25	0

for $m = 3$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 0, 1, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 16, 17, 18, 20, 21, 22, 25$ is obtained based on a respective value according to:

n	**value**
0	201
1	18
3	165
4	5
6	45
7	142
8	16
10	34
11	155
12	213
13	147
14	69
16	96
17	74
18	99
20	30
21	158
22	1
25	0

for $m = 4$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 1, 26$ is obtained based on a respective value according to:

n	**value**
0	170
1	10
26	0

generating encoded data, by the transmitting device, based on encoding the information with the determined parity check matrix; and

transmitting, by a transceiver of the transmitting device, the encoded data over the communication channel.

2. The method according to claim 1, wherein for each value of $m = 0, \ldots, 4$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ of the parity check matrix is obtained further based on a value of the non-negative integer Z.

3. The method according to claim 1, wherein

for $m = 0$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of n other than $0, 1, 2, 3, 5, 6, 9, 10, 11, 12, 13, 15, 16, 18, 19, 20, 21, 22, 23$ is equal to an all-zero matrix of size $Z \times Z$,

for $m = 1$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of n other than $0, 2, 3, 4, 5, 7, 8, 9, 11, 12, 14, 15, 16, 17, 19, 21, 22, 23, 24$ is equal to an all-zero matrix of size $Z \times Z$,

for $m = 2$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of n other than $0, 1, 2, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 17, 18, 19, 20, 24, 25$ is equal to an all-zero matrix of size $Z \times Z$,

for $m = 3$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of n other than

$0, 1, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 16, 17, 18, 20, 21, 22, 25$ is equal to an all-zero matrix of size $Z \times Z$, and

for $m = 4$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of n other than $0, 1, 26$ is equal to an all-zero matrix of size $Z \times Z$.

4. The method according to claim 1, wherein the parity check matrix has $46Z$ rows, and

wherein:

for $m = 5$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 0, 1, 3, 12, 16, 21, 22$ is obtained based on a respective value according to:

n	**value**
0	164
1	59
3	86
12	80
16	182
21	130
22	153

for $m = 6$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 0, 6, 10, 11, 13, 17, 18, 20$ is obtained based on a respective value according to:

n	**value**
0	158
6	119
10	113
11	21
13	63
17	51
18	136
20	116

for $m = 7$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 0, 1, 4, 7, 8, 14$ is obtained based on a respective value

according to:

n	value
0	17
1	76
4	104
7	100
8	150
14	158

for $m = 8$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 0, 1, 3, 12, 16, 19, 21, 22, 24$ is obtained based on a respective value according to:

n	value
0	33
1	95
3	4
12	217
16	204
19	39
21	58
22	44
24	201

for $m = 9$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 0, 1, 10, 11, 13, 17, 18, 20$ is obtained based on a respective value according to:

n	value
0	9
1	37
10	213
11	105
13	89
17	185
18	109
20	218

for $m = 10$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 1, 2, 4, 7, 8, 14$ is obtained based on a respective value

according to:

n	value
1	82
2	165
4	174
7	19
8	194
14	103

for $m = 11$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 1, 12, 16, 21, 22, 23$ is obtained based on a respective value according to:

n	value
0	52
1	11
12	2
16	35
21	32
22	84
23	201

for $m = 12$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 1, 10, 11, 13, 18$ is obtained based on a respective value according to:

n	value
0	142
1	175
10	136
11	3
13	28
18	182

for $m = 13$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 3, 7, 20, 23$ is obtained based on a respective value according to:

n	value
0	81

3	56
7	72
20	217
23	78

for $m = 14$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 12, 15, 16, 17, 21$ is obtained based on a respective value according to:

n	**value**
0	14
12	175
15	211
16	191
17	51
21	43

for $m = 15$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 1, 10, 13, 18, 25$ is obtained based on a respective value according to:

n	**value**
0	90
1	120
10	131
13	209
18	209
25	81

for $m = 16$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 3, 11, 20, 22$ is obtained based on a respective value according to:

n	**value**
1	154
3	164
11	43
20	189
22	101

for $m = 17$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to

$(n+1)Z-1$ for each value of $n = 0, 14, 16, 17, 21$ is obtained based on a respective value according to:

n	**value**
0	56
14	110
16	200
17	63
21	4

for $m = 18$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 12, 13, 18, 19$ is obtained based on a respective value according to:

n	**value**
1	199
12	110
13	200
18	143
19	186

for $m = 19$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 1, 7, 8, 10$ is obtained based on a respective value according to:

n	**value**
0	8
1	6
7	103
8	198
10	8

for $m = 20$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 3, 9, 11, 22$ is obtained based on a respective value according to:

n	**value**
0	105
3	210
9	121
11	214

22	183

for $m = 21$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 5, 16, 20, 21$ is obtained based on a respective value according to:

n	**value**
1	192
5	131
16	220
20	50
21	106

for $m = 22$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 12, 13, 17$ is obtained based on a respective value according to:

n	**value**
0	53
12	0
13	3
17	148

for $m = 23$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 2, 10, 18$ is obtained based on a respective value according to:

n	**value**
1	88
2	203
10	168
18	122

for $m = 24$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 3, 4, 11, 22$ is obtained based on a respective value according to:

n	**value**
0	49
3	157
4	64
11	193

22	124

for $m = 25$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 6, 7, 14$ is obtained based on a respective value according to:

n	**value**
1	1
6	166
7	65
14	81

for $m = 26$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 2, 4, 15$ is obtained based on a respective value according to:

n	**value**
0	107
2	176
4	212
15	127

for $m = 27$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 6, 8$ is obtained based on a respective value according to:

n	**value**
1	208
6	141
8	174

for $m = 28$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 4, 19, 21$ is obtained based on a respective value according to:

n	**value**
0	146
4	153
19	217
21	114

for $m = 29$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 14, 18, 25$ is obtained based on a respective value according to:

n	value
1	150
14	11
18	53
25	68

for $m = 30$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 10, 13, 24$ is obtained based on a respective value according to:

n	value
0	34
10	130
13	210
24	123

for $m = 31$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 7, 22, 25$ is obtained based on a respective value according to:

n	value
1	175
7	49
22	177
25	128

for $m = 32$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 12, 14, 24$ is obtained based on a respective value according to:

n	value
0	192
12	209
14	58
24	30

for $m = 33$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 2, 11, 21$ is obtained based on a respective value according to:

n	value
1	114

2	49
11	161
21	137

for $m = 34$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 7, 15, 17$ is obtained based on a respective value according to:

n	**value**
0	82
7	186
15	68
17	150

for $m = 35$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 6, 12, 22$ is obtained based on a respective value according to:

n	**value**
1	192
6	173
12	26
22	187

for $m = 36$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 14, 15, 18$ is obtained based on a respective value according to:

n	**value**
0	222
14	157
15	0
18	6

for $m = 37$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 13, 23$ is obtained based on a respective value according to:

n	**value**
1	81
13	195
23	138

for $m = 38$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 9, 10, 12$ is obtained based on a respective value according to:

n	**value**
0	123
9	90
10	73
12	10

for $m = 39$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 3, 7, 19$ is obtained based on a respective value according to:

n	**value**
1	12
3	77
7	49
19	114

for $m = 40$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 8, 17$ is obtained based on a respective value according to:

n	**value**
0	67
8	45
17	96

for $m = 41$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 3, 9, 18$ is obtained based on a respective value according to:

n	**value**
1	23
3	215
9	60
18	167

for $m = 42$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 4, 2$ is obtained based on a respective value according to:

n	**value**

0	114
4	91
24	78

for $m = 43$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 16, 18, 25$ is obtained based on a respective value according to:

n	**value**
1	206
16	22
18	134
25	161

for $m = 44$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 7, 9, 22$ is obtained based on a respective value according to:

n	**value**
0	84
7	4
9	9
22	12

for $m = 45$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 6, 10$ is obtained based on a respective value according to:

n	**value**
1	184
6	121
10	29

.

5. The method according to claim 4, wherein for each value of $m = 5, \ldots, 45$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ of the parity check matrix is obtained further based on a value of *Z*.

6. The method according to claim 1, wherein the parity check matrix has at least $46Z$ rows and $68Z$ columns, and

wherein for $m = 5, \ldots, 45$:

each submatrix arranged along the 41 diagonal elements of the parity check matrix in rows mZ to $(m+1)Z-1$ and in columns $(m+22)Z$ to $(m+23)Z-1$ is an un-shifted identity matrix of size $Z \times Z$, and

each submatrix except for those along the 41 diagonal elements is an all-zero matrix of size $Z \times Z$.

7. method according to claim 1, wherein generating the encoded data, by the transmitting device, based on encoding the information with the determined parity check matrix comprises:

generating, based on the information and the parity check matrix, a plurality of parity bits $\vec{\boldsymbol{p}}$ that satisfy:

$$H \cdot (\vec{\boldsymbol{x}} \quad \vec{\boldsymbol{p}})^T = 0,$$

where *H* is the parity check matrix, and $\vec{\boldsymbol{x}}$ is the information.

8. The method according to claim 1, wherein for each value of $m = 0, \ldots, 4$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ of the parity check matrix is equal to a circularly column-shifted identity matrix of size $Z \times Z$ that is circularly column-shifted to the right.

9. The method according to claim 1, wherein the *Z* of each submatrix is related to a size of the information that is encoded by the transmitting device.

10. The method according to claim 9, wherein the *Z* represents a lifting value that is any one of 7, 14, 28, 56, 112, or 224, and

wherein the size of the information is 22 times *Z*.

11. The method according to claim 1, further comprising:

determining a base matrix of size at least 5×27 in which an element at location (m, n) of the base matrix indicates whether the submatrix in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ of the parity check matrix is equal to the circularly column-shifted identity

matrix of size $Z \times Z$ that is circularly column-shifted to the right.

12. A transmitting device configured to encode, based on a parity check matrix of a low-density parity-check code, information for transmission over a communication channel, the transmitting device comprising:

a transceiver;

at least one processor; and

at least one computer memory operably connectable to the at least one processor and storing instructions that, when executed, cause the at least one processor to perform operations comprising:

determining the parity check matrix comprising a plurality of-submatrices that each have dimension $Z \times Z$ for a non-negative integer Z, wherein among the plurality of submatrices:

for $m = 0$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 1, 2, 3, 5, 6, 9, 10, 11, 12, 13, 15, 16, 18, 19, 20, 21, 22, 23$ is obtained based on a respective value according to:

n	**value**
0	223
1	16
2	94
3	91
5	74
6	10
9	0
10	205
11	216
12	21
13	215
15	14
16	70

18	141
19	198
20	104
21	81
22	1
23	0

for $m = 1$, the submatrix arranged in rows mZ to $(m+1)Z - 1$ and in columns nZ to $(n+1)Z - 1$ for each value of $n = 0, 2, 3, 4, 5, 7, 8, 9, 11, 12, 14, 15, 16, 17, 19, 21, 22, 23, 24$ is obtained based on a respective value according to:

n	**value**
0	141
2	45
3	151
4	46
5	119
7	157
8	133
9	87
11	206
12	93
14	79
15	9
16	118
17	194
19	31
21	187
22	0
23	0
24	0

for $m = 2$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 0, 1, 2, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 17, 18, 19, 20, 24, 25$ is obtained based on a respective value according to:

n	**value**
0	207
1	203
2	31
4	176
5	180
6	186
7	95
8	153
9	177
10	70
13	77
14	214
15	77
17	198
18	117
19	223
20	90
24	0
25	0

for $m = 3$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 0, 1, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 16, 17, 18, 20, 21, 22, 25$ is obtained based on a respective value according to:

n	**value**
0	201

1	18
3	165
4	5
6	45
7	142
8	16
10	34
11	155
12	213
13	147
14	69
16	96
17	74
18	99
20	30
21	158
22	1
25	0

for $m = 4$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 0, 1, 26$ is obtained based on a respective value according to:

n	**value**
0	170
1	10
26	0

generating encoded data based on encoding the information with the determined parity check matrix; and

transmitting, through the transceiver, the encoded data over the communication channel.

13. The transmitting device according to claim 12, wherein for each value of $m = 0, \dots, 4$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to

$(n+1)Z-1$ of the parity check matrix is obtained further based on a value of the non-negative integer Z.

14. The transmitting device according to claim 13, wherein for each value of $m = 0, \ldots, 4$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ of the parity check matrix is equal to a circularly column-shifted identity matrix of size $Z \times Z$ that is circularly column-shifted to the right.

15. The transmitting device according to claim 13, wherein the Z of each submatrix is related to a size of the information that is encoded by the transmitting device.

16. The transmitting device according to claim 12, wherein

for $m = 0$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ of the parity check matrix for each value of n other than $0, 1, 2, 3, 5, 6, 9, 10, 11, 12, 13, 15, 16, 18, 19, 20, 21, 22, 23$ is equal to an all-zero matrix of size $Z \times Z$,

for $m = 1$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ of the parity check matrix for each value of n other than $0, 2, 3, 4, 5, 7, 8, 9, 11, 12, 14, 15, 16, 17, 19, 21, 22, 23, 24$ is equal to an all-zero matrix of size $Z \times Z$,

for $m = 2$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ of the parity check matrix for each value of n other than $0, 1, 2, 4, 5, 6, 7, 8, 9, 10, 13, 14, 15, 17, 18, 19, 20, 24, 25$ is equal to an all-zero matrix of size $Z \times Z$,

for $m = 3$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ of the parity check matrix for each value of n other than $0, 1, 3, 4, 6, 7, 8, 10, 11, 12, 13, 14, 16, 17, 18, 20, 21, 22, 25$ is equal to an all-zero matrix of size $Z \times Z$, and

for $m = 4$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ of the parity check matrix for each value of n -other than $0, 1, 26$ is equal to an all-zero matrix of size $Z \times Z$.

17. The transmitting device according to claim 12, wherein the parity check matrix has $46Z$ rows, and

wherein:

for $m = 5$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 0, 1, 3, 12, 16, 21, 22$ is obtained based on a respective value according to:

n	**value**
0	164
1	59
3	86
12	80
16	182
21	130
22	153

for $m = 6$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 0, 6, 10, 11, 13, 17, 18, 20$ is obtained based on a respective value according to:

n	**value**
0	158
6	119
10	113
11	21
13	63
17	51
18	136
20	116

for $m = 7$, the submatrix arranged in rows mZ to $(m + 1)Z - 1$ and in columns nZ to $(n + 1)Z - 1$ for each value of $n = 0, 1, 4, 7, 8, 14$ is obtained based on a respective value according to:

n	value
0	17
1	76
4	104
7	100
8	150
14	158

for $m = 8$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 1, 3, 12, 16, 19, 21, 22, 24$ is obtained based on a respective value according to:

n	value
0	33
1	95
3	4
12	217
16	204
19	39
21	58
22	44
24	201

for $m = 9$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 1, 10, 11, 13, 17, 18, 20$ is obtained based on a respective value according to:

n	value
0	9
1	37
10	213
11	105
13	89
17	185

18	109
20	218

for $m = 10$, the submatrix arranged in rows mZ to $(m+1)Z - 1$ and in columns nZ to $(n+1)Z - 1$ for each value of $n = 1, 2, 4, 7, 8, 14$ is obtained based on a respective value according to:

n	**value**
1	82
2	165
4	174
7	19
8	194
14	103

for $m = 11$, the submatrix arranged in rows mZ to $(m+1)Z - 1$ and in columns nZ to $(n+1)Z - 1$ for each value of $n = 0, 1, 12, 16, 21, 22, 23$ is obtained based on a respective value according to:

n	**value**
0	52
1	11
12	2
16	35
21	32
22	84
23	201

for $m = 12$, the submatrix arranged in rows mZ to $(m+1)Z - 1$ and in columns nZ to $(n+1)Z - 1$ for each value of $n = 0, 1, 10, 11, 13, 18$ is obtained based on a respective value according to:

n	**value**
0	142
1	175
10	136

11	3
13	28
18	182

for $m = 13$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 3, 7, 20, 23$ is obtained based on a respective value according to:

n	**value**
0	81
3	56
7	72
20	217
23	78

for $m = 14$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 12, 15, 16, 17, 21$ is obtained based on a respective value according to:

n	**value**
0	14
12	175
15	211
16	191
17	51
21	43

for $m = 15$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 1, 10, 13, 18, 25$ is obtained based on a respective value according to:

n	**value**
0	90
1	120
10	131
13	209

18	209
25	81

for $m = 16$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 3, 11, 20, 22$ is obtained based on a respective value according to:

n	**value**
1	154
3	164
11	43
20	189
22	101

for $m = 17$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 14, 16, 17, 21$ is obtained based on a respective value according to:

n	**value**
0	56
14	110
16	200
17	63
21	4

for $m = 18$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 12, 13, 18, 19$ is obtained based on a respective value according to:

n	**value**
1	199
12	110
13	200
18	143
19	186

for $m = 19$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to

$(n+1)Z-1$ for each value of $n = 0, 1, 7, 8, 10$ is obtained based on a respective value according to:

n	**value**
0	8
1	6
7	103
8	198
10	8

for $m = 20$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 3, 9, 11, 22$ is obtained based on a respective value according to:

n	**value**
0	105
3	210
9	121
11	214
22	183

for $m = 21$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 5, 16, 20, 21$ is obtained based on a respective value according to:

n	**value**
1	192
5	131
16	220
20	50
21	106

for $m = 22$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 12, 13, 17$ is obtained based on a respective value according to:

n	**value**

0	53
12	0
13	3
17	148

for $m = 23$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 2, 10, 18$ is obtained based on a respective value according to:

n	**value**
1	88
2	203
10	168
18	122

for $m = 24$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 3, 4, 11, 22$ is obtained based on a respective value according to:

n	**value**
0	49
3	157
4	64
11	193
22	124

for $m = 25$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 6, 7, 14$ obtained based on a respective value according to:

n	**value**
1	1
6	166
7	65
14	81

for $m = 26$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 2, 4, 15$ is obtained based on a respective value according

to:

n	**value**
0	107
2	176
4	212
15	127

for $m = 27$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 6, 8$ is obtained based on a respective value according to:

n	**value**
1	208
6	141
8	174

for $m = 28$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 4, 19, 21$ is obtained based on a respective value according to:

n	**value**
0	146
4	153
19	217
21	114

for $m = 29$, the submatrix arranged in rows mZ to $(m+1)Z-1$ ~~$(m+1)Z$~~ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 14, 18, 25$ is obtained based on a respective value according to:

n	**value**
1	150
14	11
18	53
25	68

for $m = 30$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 10, 13, 24$ is obtained based on a respective value

according to:

n	**value**
0	34
10	130
13	210
24	123

for $m = 31$, the submatrix arranged in rows mZ to $(m+1)Z-1$ in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 7, 22, 25$ is obtained based on a respective value according to:

n	**value**
1	175
7	49
22	177
25	128

for $m = 32$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 12, 14, 24$ is obtained based on a respective value according to:

n	**value**
0	192
12	209
14	58
24	30

for $m = 33$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 2, 11, 21$ is obtained based on a respective value according to:

n	**value**
1	114
2	49
11	161
21	137

for $m = 34$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 7, 15, 17$ obtained based on a respective value according to:

n	**value**
0	82
7	186
15	68
17	150

for $m = 35$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 6, 12, 22$ is obtained based on a respective value according to:

n	**value**
1	192
6	173
12	26
22	187

for $m = 36$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 14, 15, 18$ obtained based on a respective value according to:

n	**value**
0	222
14	157
15	0
18	6

for $m = 37$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 13, 23$ is obtained based on a respective value according to:

n	**value**
1	81
13	195

23	138

for $m = 38$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 9, 10, 12$ obtained based on a respective value according to:

n	**value**
0	123
9	90
10	73
12	10

for $m = 39$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 3, 7, 19$ is obtained based on a respective value according to:

n	**value**
1	12
3	77
7	49
19	114

for $m = 40$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 8, 17$ is obtained based on a respective value according to:

n	**value**
0	67
8	45
17	96

for $m = 41$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 3, 9, 18$ is obtained based on a respective value according to:

n	**value**
1	23
3	215
9	60

18	167

for $m = 42$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 4, 24$ is obtained based on a respective value according to:

n	**value**
0	114
4	91
24	78

for $m = 43$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 16, 18, 25$ s obtained based on a respective value according to:

n	**value**
1	206
16	22
18	134
25	161

for $m = 44$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 0, 7, 9, 22$ is obtained based on a respective value according to:

n	**value**
0	84
7	4
9	9
22	12

for $m = 45$, the submatrix arranged in rows mZ to $(m+1)Z-1$ and in columns nZ to $(n+1)Z-1$ for each value of $n = 1, 6, 10$ is obtained based on a respective value according to:

n	**value**
1	184
6	121
10	29

18. The transmitting device according to claim 12, wherein the parity check matrix has at least $46Z$ rows and $68Z$ columns, and

wherein for $m = 5, \ldots, 45$:

each submatrix arranged along the 41 diagonal elements of the parity check matrix in rows mZ to $(m+1)Z-1$ and in columns $(m+22)Z$ to $(m+23)Z-1$ is an un-shifted identity matrix of size $Z \times Z$, and

each submatrix except for those along the 41 diagonal elements is an all-zero matrix of size $Z \times Z$.

19. The transmitting device according to claim 12, wherein the Z represents a lifting value that is any one of 7, 14, 28, 56, 112, or 224, and

wherein the size of the information is 22 times Z.