

CLAIMS

~~{Claim 1}~~

1. An image coding method for coding an image, comprising:

quantizing a plurality of coefficients of blocks in the image; and
coding coefficient information indicating the plurality of
coefficients and quantization information used in the quantizing,

wherein the quantization information includes at least one of

~~coding (i) coefficient information indicating a plurality of
coefficients of one or more blocks included in the image, (ii) (i) a first~~

flag indicating whether or not to ~~quantize the one or more blocks are~~
quantized using a plurality of quantization matrices each having
coefficients respectively corresponding to the plurality of coefficients
of the ~~one or more blocks~~, ~~(iii) (ii) a second flag indicating whether or~~

not the plurality of quantization matrices are included in a sequence
parameter set, and ~~(iv) (iii) a third flag indicating whether or not the~~
plurality of quantization matrices are included in a picture parameter
set, and

~~quantizing the plurality of coefficients,~~

~~wherein when all of the one or more blocks are quantized in the~~
quantizing using only a plurality of default matrices as the plurality of
quantization matrices, the following are coded as the quantization
information ~~in the coding~~: (i) the first flag indicating that the ~~one or~~
~~more blocks are quantized using the plurality of quantization matrices,~~

(ii) the second flag indicating that the plurality of quantization
matrices are not included in the sequence parameter set, and (iii) the
third flag indicating that the plurality of quantization matrices are not
included in the picture parameter set.

~~{Claim 2}~~

2. The image coding method according to Claim 1,

wherein, when the ~~one or more blocks are quantized in the~~
quantizing using a plurality of flat matrices each having same
coefficients instead of the plurality of quantization matrices, the first
flag indicating that the plurality of quantization matrices are not

quantized is coded in the coding.

[Claim 3]

3. The image coding method according to Claim 1 or Claim 2,

5 wherein, when the ~~one or more~~ blocks are quantized in the quantizing using the plurality of quantization matrices, in the coding:

the following are coded: (i) the first flag indicating that the ~~one or more~~ blocks are quantized using the plurality of quantization
10 matrices, and (ii) the second flag indicating that the plurality of quantization matrices are included in the sequence parameter set, or the third flag indicating that the plurality of quantization matrices are included in the picture parameter set;

15 the plurality of quantization matrices are included in the sequence parameter set when the second flag indicating that the plurality of quantization matrices are included in the sequence parameter set is coded; and

the plurality of quantization matrices are included in the picture parameter set when the third flag indicating that the plurality of
20 quantization matrices are included in the picture parameter set is coded.

[Claim 4]

4. The image coding method according to Claim 3,

25 wherein in the coding:

when the plurality of quantization matrices included in a parameter set which is one of the sequence parameter set and the picture parameter set includes a first quantization matrix and a second quantization matrix, and the first quantization matrix is equal
30 to the second quantization matrix, an identifier indicating the second quantization matrix is included, in the parameter set, as a copy matrix identifier indicating a matrix whose copy is used as the first quantization matrix; and

when the plurality of quantization matrices included in the
35 parameter set includes the first quantization matrix, and the first

quantization matrix is equal to one of the default matrices, an identifier indicating the default matrix is included as the copy matrix identifier in the parameter set.

5 **~~[Claim 5]~~**

5. The image coding method according to any one of Claim 1 to Claim 4, comprising:

setting a plurality of sequence quantization matrices for a sequence including a picture; and

10 setting a plurality of picture quantization matrices for the picture,

wherein in the coding:

the first flag is coded which indicates that the ~~one or more~~ blocks are quantized using the plurality of quantization matrices, when the ~~one or more~~ blocks of the picture are quantized using, as the plurality of quantization matrices, the plurality of picture quantization matrices which have been set for the picture;

the second flag is coded which indicates that the plurality of quantization matrices are not included in the sequence parameter set, when the plurality of default matrices have been set for the sequence as the plurality of sequence quantization matrices; and

the third flag is coded which indicates that the plurality of quantization matrices are not included in the picture parameter set, when the plurality of sequence quantization matrices which have been set for the sequence are set for the picture as the plurality of picture quantization matrices.

~~[Claim 6]~~

6. The image coding method according to any one of Claim 1 to Claim 5,

wherein when a block not subject to transform is quantized using a flat matrix having same coefficients, and a block subject to transform is quantized using one of the default matrices,

the following are coded in the coding: (i) the first flag indicating that the ~~one or more~~ blocks are quantized using the plurality of

quantization matrices, (ii) the second flag indicating that the plurality of quantization matrices are not included in the sequence parameter set, and (iii) the third flag indicating that the plurality of quantization matrices are not included in the picture parameter set.

5

[Claim 7]

7. An image decoding method for decoding ~~a coded bitstream to decode an image~~, the method comprising:

10 decoding coefficient information indicating a plurality of coefficients of blocks in the image and quantization information used in inverse quantization of the plurality of coefficients; and
inverse-quantizing the plurality of coefficients,
wherein the quantization information includes at least one of
~~decoding, from the coded bitstream, (i) coefficient information~~
15 ~~indicating a plurality of coefficients of one or more blocks included in the image, (ii) (i) a first flag indicating whether or not to inverse-quantize the one or more blocks have been quantized using a plurality of quantization matrices each having coefficients respectively corresponding to the plurality of coefficients of the one or~~
20 ~~more blocks, (iii) (ii) a second flag indicating whether or not the plurality of quantization matrices are included in a sequence parameter set, and (iv) (iii) a third flag indicating whether or not the plurality of quantization matrices are included in a picture parameter set;~~ and
25 ~~inverse-quantizing the coefficient information,~~
~~wherein when the following are have been decoded as the~~
quantization information in the decoding: (i) the first flag indicating that the one or more blocks are inverse-quantized have been quantized using the plurality of quantization matrices, (ii) the second
30 flag indicating that the plurality of quantization matrices are not included in the sequence parameter set, and (iii) the third flag indicating that the plurality of quantization matrices are not included in the picture parameter set, the coefficient information is all of the blocks are inverse-quantized in the inverse-quantizing using only the
35 plurality of default matrices as the plurality of quantization matrices.

~~{Claim 8}~~

8. The image decoding method according to Claim 7,
wherein when the first flag ~~is~~ has been decoded which indicates
5 that the ~~one or more blocks are not inverse-quantized~~ have not been
quantized using the plurality of quantization matrices, the ~~coefficient~~
~~information is~~ blocks are inverse-quantized in the inverse-quantizing
using the plurality of flat matrices each having same coefficients
instead of the plurality of quantization matrices.

10

~~{Claim 9}~~

9. The image decoding method according to Claim 7 or Claim 8,
wherein in the inverse-quantizing:

~~the coefficient information is~~ the blocks have been
15 inverse-quantized using the plurality of quantization matrices
included in the sequence parameter set, when the following ~~are~~ have
been decoded: the first flag indicating that the ~~one or more blocks are~~
~~inverse-quantized~~ have been quantized using the plurality of
quantization matrices and the second flag indicating that the plurality
20 of quantization matrices are included in the sequence parameter set;
and

~~the coefficient information is~~ blocks are inverse-quantized
using the plurality of quantization matrices included in the picture
parameter set, when the following ~~are~~ have been decoded: the first
25 flag indicating that the ~~one or more blocks are~~ ~~inverse-quantized~~ have
been quantized using the plurality of quantization matrices and the
third flag indicating that the plurality of quantization matrices are
included in the picture parameter set.

30 **~~{Claim 10}~~**

10 The image decoding method according to Claim 9,
wherein when a parameter set which is one of the sequence
parameter set and the picture parameter set includes the plurality of
quantization matrices including a first quantization matrix and a
35 second quantization matrix, and the parameter set includes an

identifier indicating the second quantization matrix as a copy matrix
identifier indicating a matrix whose copy is used as the first
quantization matrix, ~~the coefficient information is~~ blocks are
inverse-quantized in the inverse-quantizing using the plurality of
5 quantization matrices including the first quantization matrix as which
a copy of the second quantization matrix is used; and

when the parameter set includes the plurality of quantization
matrices including the first quantization matrix, and the parameter
set includes an identifier indicating one of the default matrices as the
10 copy matrix identifier, ~~the coefficient information is~~ blocks are
inverse-quantized in the inverse-quantizing using the plurality of
quantization matrices including the first quantization matrix as which
a copy of the default matrix is used.

15 **~~[Claim 11]~~**

11. The image decoding method according to any one of Claim 7 to
Claim 10, further comprising:

setting a plurality of sequence quantization matrices for a
sequence including a picture; and

20 setting a plurality of picture quantization matrices for the
picture,

wherein ~~the coefficient information~~ blocks of the picture is
inverse-quantized in the inverse-quantizing using, as the plurality of
quantization matrices, the plurality of picture quantization matrices
25 which have been set for the picture, when the first flag is has been
decoded which indicates that ~~the one or more blocks are~~ have been
~~inverse-quantized~~ quantized using the plurality of quantization
matrices, and

in the setting:

30 the plurality of default matrices for the sequence are set as the
plurality of sequence quantization matrices, when the second flag is
has been decoded which indicates that the plurality of quantization
matrices are not included in the sequence parameter set; and

the plurality of sequence quantization matrices which have
35 been set for the sequence are set for the picture as the plurality of

picture quantization matrices, when the third flag is has been decoded which indicates that the plurality of quantization matrices are not included in the picture parameter set.

5 ~~[Claim 12]~~

12. The image decoding method according to any one of Claim 7 to 11,

wherein when the following are have been decoded: (i) the first flag indicating that the ~~one or more blocks are inverse-quantized~~ have been quantized using the plurality of quantization matrices, (ii) the
10 second flag indicating that the plurality of quantization matrices are not included in the sequence parameter set, and (iii) the third flag indicating that the plurality of quantization matrices are not included in the picture parameter set,

15 ~~the coefficient information of a block not subject to transform is inverse-quantized in the inverse-quantizing using a flat matrix having same coefficients, and the a coefficient information of a block subject to transform is inverse-quantized in the inverse-quantizing using one of the default matrices.~~

20

~~[Claim 13]~~

13. An image coding apparatus which codes an image, the apparatus comprising:

processing circuitry; and
25 storage accessible from the processing circuit,
wherein the processing circuitry executes, using the storage,
quantizing a plurality of coefficients of blocks in the image, and
coding coefficient information indicating the plurality of
coefficients and quantization information used in the quantizing,
30 wherein the quantization information includes at least one of
coding (i) coefficient information indicating a plurality of
coefficients of one or more blocks included in the image, (ii) (i) a first
flag indicating whether or not to quantize the one or more blocks are
quantized using a plurality of quantization matrices each having
35 coefficients respectively corresponding to the plurality of coefficients

of the ~~one or more blocks~~, ~~(iii)~~ (ii) a second flag indicating whether or not the plurality of quantization matrices are included in a sequence parameter set, and ~~(iv)~~ (iii) a third flag indicating whether or not the plurality of quantization matrices are included in a picture parameter set_{7L} and

quantizing the ~~plurality of coefficients~~,
— wherein when all of the one or more blocks are quantized in the quantizing using only a plurality of default matrices as the plurality of quantization matrices, the following are coded as the quantization
10 information in the coding: (i) the first flag indicating that the ~~one or more blocks~~ are quantized using the plurality of quantization matrices, (ii) the second flag indicating that the plurality of quantization matrices are not included in the sequence parameter set, and (iii) the third flag indicating that the plurality of quantization matrices are not
15 included in the picture parameter set.

{Claim 14}

14. An image decoding apparatus which decodes a coded bitstream to ~~decode an image~~, the apparatus comprising:

20 processing circuitry; and
storage accessible from the processing circuitry,
wherein the processing circuitry executes, using the storage,
decoding coefficient information indicating a plurality of
coefficients of blocks in the image and quantization information used
25 in inverse quantization of the plurality of coefficients, and
inverse-quantizing the plurality of coefficients,
wherein the quantization information includes at least one of
— ~~decoding, from the coded bitstream, (i) coefficient information~~
~~indicating a plurality of coefficients of one or more blocks included in~~
30 ~~the image, (ii)~~ (i) a first flag indicating whether or not to ~~inverse-quantize the one or more blocks~~ have been quantized using a plurality of quantization matrices each having coefficients respectively corresponding to the plurality of coefficients ~~of the one or more blocks~~, ~~(iii)~~ (ii) a second flag indicating whether or not the
35 plurality of quantization matrices are included in a sequence

parameter set, and ~~(iv)~~ (iii) a third flag indicating whether or not the plurality of quantization matrices are included in a picture parameter set, and

~~inverse-quantizing the coefficient information,~~

5 ~~wherein when the following have been~~ are decoded as the quantization information in the decoding: (i) the first flag indicating that the ~~one or more blocks are inverse-quantized have been quantized~~ using the plurality of quantization matrices, (ii) the second flag indicating that the plurality of quantization matrices are not
10 included in the sequence parameter set, and (iii) the third flag indicating that the plurality of quantization matrices are not included in the picture parameter set, all of the blocks are
~~the coefficient information is inverse-quantized in the~~
inverse-quantizing using only the plurality of default matrices as the
15 plurality of quantization matrices.

{Claim 15}

15. An image coding and decoding apparatus, comprising:

the image coding apparatus according to Claim 13; and

20 an image decoding apparatus which decodes ~~a coded bitstream to decode an image~~, the image decoding apparatus including:

processing circuitry; and

storage accessible from the processing circuitry,

wherein the processing circuitry executes, using the storage,

25 decoding coefficient information indicating a plurality of coefficients of blocks in the image and quantization information used in inverse quantization of the plurality of coefficients, and

inverse-quantizing the plurality of coefficients,

wherein the quantization information includes at least one of

30 ~~decoding, from the coded bitstream, (i) coefficient information indicating a plurality of coefficients of one or more blocks included in the image, (ii)~~ (i) a first flag indicating whether or not to inverse-quantize the one or more blocks have been quantized using a plurality of quantization matrices each having coefficients
35 respectively corresponding to the plurality of coefficients of the one or

~~more blocks, (iii)-(ii) a second flag indicating whether or not the plurality of quantization matrices are included in a sequence parameter set, and (iv)-(iii) a third flag indicating whether or not the plurality of quantization matrices are included in a picture parameter~~

5 ~~set_{7L} and~~

~~inverse-quantizing the coefficient information,~~

~~———wherein when the following have been are decoded as the quantization information in the decoding: (i) the first flag indicating that the ~~one or more blocks are inverse-quantized~~ have~~
10 ~~been quantized using the plurality of quantization matrices, (ii) the second flag indicating that the plurality of quantization matrices are not included in the sequence parameter set, and (iii) the third flag indicating that the plurality of quantization matrices are not included in the picture parameter set, all of the blocks are~~

15 ~~———the coefficient information is inverse-quantized in the inverse-quantizing using only the plurality of default matrices as the plurality of quantization matrices.~~