CLAIMS

1. A signal processing apparatus comprising:

a demultiplexing unit that demultiplexes input encoded data to at least low band encoded data and coefficient information;

a low band decoding unit that decodes the low band encoded data to produce low band signals;

a selection unit that selects a coefficient table which is obtained based on the coefficient information among a plurality of coefficient tables used for the production of high band signals and having coefficients for the respective sub-bands on a high band side;

an extension and reduction unit that deletes the coefficients of some sub-bands to reduce the coefficient table or produces the coefficients of predetermined sub-bands based on the coefficients of some sub-bands to extend the coefficient table;

a high band sub-band power calculation unit that calculates high band sub-band powers of high band sub-band signals of the respective sub-bands constituting the high band signals based on low band sub-band signals of the respective sub-bands constituting the low band signals and the extended or reduced coefficient table; and

a high band signal production unit that produces the high band signals based on the high band sub-band powers and the low band sub-band signals,

wherein the extension and reduction unit duplicates the coefficients of a sub-band having a highest frequency which is included in the coefficient table and sets the duplicated coefficients to coefficients of a sub-band having a higher frequency than the highest frequency to extend the coefficient table.

~~2. The signal processing apparatus according to claim 1, wherein the extension and reduction unit duplicates the coefficients of a sub-band having a highest frequency which is included in the coefficient table and sets the duplicated coefficients to coefficients of a sub-band having a higher frequency than the highest frequency to extend the coefficient table.~~

~~32~~2. The signal processing apparatus according to claim 1, wherein the extension and reduction unit deletes the coefficients of a sub-band, which has a higher frequency than that of a sub-band having a highest frequency among sub-bands of the high band sub-band signals, from the coefficient table to reduce the coefficient table.

~~43~~3. A signal processing method of a signal processing apparatus which includes

a demultiplexing unit that demultiplexes input encoded data to at least low band encoded data and coefficient information,

a low band decoding unit that decodes the low band encoded data to produce low band signals,

a selection unit that selects a coefficient table which is obtained based on the coefficient information among a plurality of coefficient tables used for the production of high band signals and having coefficients for the respective sub-bands on a high band side,

an extension and reduction unit that deletes the coefficients of some sub-bands to reduce the coefficient table or produces the coefficients of predetermined sub-bands based on the coefficients of some sub-bands to extend the coefficient table,

a high band sub-band power calculation unit that calculates high band sub-band powers of high band sub-band signals of the respective sub-bands constituting the high band signals based on low band sub-band signals of the respective sub-bands constituting the low band signals and the extended or reduced coefficient table, and

a high band signal production unit that produces the high band signals based on the high band sub-band powers and the low band sub-band signals,

the method comprising the steps of causing:

the demultiplexing unit to demultiplex the encoded data;

the low band decoding unit to produce the low band signals;

the selection unit to select the coefficient table;

the extension and reduction unit to reduce or extend the coefficient table;

the high band sub-band power calculation unit to

calculate the high band sub-band powers; and

the high band signal production unit to produce the high band signals,

wherein the extension and reduction unit duplicates the coefficients of a sub-band having a highest frequency which is included in the coefficient table and sets the duplicated coefficients to coefficients of a sub-band having a higher frequency than the highest frequency to extend the coefficient table.

4. The signal processing method according to claim 3, wherein the extension and reduction unit deletes the coefficients of a sub-band, which has a higher frequency than that of a sub-band having a highest frequency among sub-bands of the high band sub-band signals, from the coefficient table to reduce the coefficient table.

5. A program causing a computer to execute processes including the steps of:

demultiplexing input encoded data to at least low band encoded data and coefficient information;

decoding the low band encoded data to produce low band signals;

selecting a coefficient table which is obtained based on the coefficient information among a plurality of coefficient tables used for the production of high band signals and having coefficients for the respective sub-bands on a high band side;

deleting the coefficients of some sub-bands to reduce the coefficient table or generating the coefficients of predetermined sub-bands based on the coefficients of some sub-bands to extend the coefficient table;

calculating high band sub-band powers of high band sub-band signals of the respective sub-bands constituting the high band signals based on low band sub-band signals of the respective sub-bands constituting the low band signals and the extended or reduced coefficient table; and

generating the high band signals based on the high band sub-band powers and the low band sub-band signals,

wherein the step of deleting the coefficients of some sub-bands comprises the steps of:

duplicating the coefficients of a sub-band having a

highest frequency which is included in the coefficient table; and

setting the duplicated coefficients to coefficients of a sub-band having a higher frequency than the highest frequency to extend the coefficient table.

6. The program according to claim 5, wherein the step of deleting the coefficients of some sub-bands comprises the step of:

deleting the coefficients of a sub-band, which has a higher frequency than that of a sub-band having a highest frequency among sub-bands of the high band sub-band signals, from the coefficient table to reduce the coefficient table.

~~6~~7. A signal processing apparatus comprising:

a sub-band division unit that produces low band sub-band signals of a plurality of sub-bands on a low band side of an input signal and high band sub-band signals of a plurality of sub-bands on a high band side of the input signal;

an extension and reduction unit that deletes the coefficients of some sub-bands to reduce a coefficient table or produces coefficients of predetermined sub-bands based on coefficients of some sub-bands to extend a coefficient table, the coefficient table having the coefficients for the respective sub-bands on the high band side;

a pseudo high band sub-band power calculation unit that calculates pseudo high band sub-band powers, which are estimated values of powers of the high band sub-band signals, for the respective sub-bands on the high band side based on the extended or reduced coefficient table and the low band sub-band signals;

a selection unit that compares high band sub-band powers of the high band sub-band signals and the pseudo high band sub-band powers to each other and selects one of a plurality of the coefficient tables; and

a production unit that produces data containing coefficient information for obtaining the selected coefficient table,

wherein the extension and reduction unit duplicates the coefficients of a sub-band having a highest frequency which is included in the coefficient table and sets the duplicated

coefficients to coefficients of a sub-band having a higher frequency than the highest frequency to extend the coefficient table.

~~7. The signal processing apparatus according to claim 6, wherein the extension and reduction unit duplicates the coefficients of a sub-band having a highest frequency which is included in the coefficient table and sets the duplicated coefficients to coefficients of a sub-band having a higher frequency than the highest frequency to extend the coefficient table.~~

~~8~~8. The signal processing apparatus according to claim ~~6~~7, wherein the extension and reduction unit deletes the coefficients of a sub-band, which has a higher frequency than that of a sub-band having a highest frequency among sub-bands of the high band sub-band signals, from the coefficient table to reduce the coefficient table.

9. A signal processing method of a signal processing apparatus which includes

a sub-band division unit that produces low band sub-band signals of a plurality of sub-bands on a low band side of an input signal and high band sub-band signals of a plurality of sub-bands on a high band side of the input signal,

an extension and reduction unit that deletes the coefficients of some sub-bands to reduce a coefficient table or produces coefficients of predetermined sub-bands based on coefficients of some sub-bands to extend a coefficient table, the coefficient table having coefficients for the respective sub-bands on the high band side,

a pseudo high band sub-band power calculation unit that calculates pseudo high band sub-band powers, which are estimated values of powers of the high band sub-band signals, for the respective sub-bands on the high band side based on the extended or reduced coefficient table and the low band sub-band signals,

a selection unit that compares high band sub-band powers of the high band sub-band signals and the pseudo high band sub-band powers to each other and selects one of a plurality of the coefficient tables, and

a production unit that produces data containing coefficient information for obtaining the selected coefficient table,

the method comprising the steps of causing:

the sub-band division unit to produces the low band sub-band signals and the high band sub-band signals;

the extension and reduction unit to reduce or extend the coefficient table;

the pseudo high band sub-band power calculation unit to calculate the pseudo high band sub-band powers;

the selection unit to select the coefficient table; and

the production unit to produce the data containing coefficient information,

wherein the extension and reduction unit duplicates the coefficients of a sub-band having a highest frequency which is included in the coefficient table and sets the duplicated coefficients to coefficients of a sub-band having a higher frequency than the highest frequency to extend the coefficient table.

10. The signal processing method according to claim 9, wherein the extension and reduction unit deletes the coefficients of a sub-band, which has a higher frequency than that of a sub-band having a highest frequency among sub-bands of the high band sub-band signals, from the coefficient table to reduce the coefficient table.

~~10~~11. A program causing a computer to execute processes including the steps of:

generating low band sub-band signals of a plurality of sub-bands on a low band side of an input signal and high band sub-band signals of a plurality of sub-bands on a high band side of the input signal;

deleting the coefficients of some sub-bands to reduce a coefficient table or generating coefficients of predetermined sub-bands based on coefficients of some sub-bands to extend a coefficient table, the coefficient table having coefficients for the respective sub-bands on the high band side;

calculating pseudo high band sub-band powers, which are estimated values of powers of the high band sub-band signals,

for the respective sub-bands on the high band side based on the extended or reduced coefficient table and the low band sub-band signals;

comparing high band sub-band powers of the high band sub-band signals and the pseudo high band sub-band powers to each other and selecting one of a plurality of the coefficient tables; and

generating data containing coefficient information for obtaining the selected coefficient table,

wherein the step of deleting the coefficients of some sub-bands comprises the steps of:

duplicating the coefficients of a sub-band having a highest frequency which is included in the coefficient table; and

setting the duplicated coefficients to coefficients of a sub-band having a higher frequency than the highest frequency to extend the coefficient table.

12. The program according to claim 11, wherein the step of deleting the coefficients of some sub-bands comprises the step of:

deleting the coefficients of a sub-band, which has a higher frequency than that of a sub-band having a highest frequency among sub-bands of the high band sub-band signals, from the coefficient table to reduce the coefficient table.

~~11~~13. A decoder comprising:

a demultiplexing unit that demultiplexes input encoded data to at least low band encoded data and coefficient information;

a low band decoding unit that decodes the low band encoded data to produce low band signals;

a selection unit that selects a coefficient table which is obtained based on the coefficient information among a plurality of coefficient tables used for the production of high band signals and having coefficients for the respective sub-bands on a high band side;

an extension and reduction unit that deletes the coefficients of some sub-bands to reduce the coefficient table or produces the coefficients of predetermined sub-bands based on the coefficients of some sub-bands to extend the coefficient

table;

a high band sub-band power calculation unit that calculates high band sub-band powers of high band sub-band signals of the respective sub-bands constituting the high band signals based on low band sub-band signals of the respective sub-bands constituting the low band signals and the extended or reduced coefficient table;

a high band signal production unit that produces the high band signals based on the high band sub-band powers and the low band sub-band signals; and

a synthesis unit that synthesizes the low band signal and the high band signal with each other to produce an output signal,

wherein the extension and reduction unit duplicates the coefficients of a sub-band having a highest frequency which is included in the coefficient table and sets the duplicated coefficients to coefficients of a sub-band having a higher frequency than the highest frequency to extend the coefficient table.

14. The decoder according to claim 13, wherein the extension and reduction unit deletes the coefficients of a sub-band, which has a higher frequency than that of a sub-band having a highest frequency among sub-bands of the high band sub-band signals, from the coefficient table to reduce the coefficient table.

~~12~~15. A decoding method of a decoder which includes

a demultiplexing unit that demultiplexes input encoded data to at least low band encoded data and coefficient information,

a low band decoding unit that decodes the low band encoded data to produce low band signals,

a selection unit that selects a coefficient table which is obtained based on the coefficient information among a plurality of coefficient tables used for the production of high band signals and having coefficients for the respective sub-bands on a high band side,

an extension and reduction unit that deletes the coefficients of some sub-bands to reduce the coefficient table or produces the coefficients of predetermined sub-bands based

on the coefficients of some sub-bands to extend the coefficient table,

a high band sub-band power calculation unit that calculates high band sub-band powers of high band sub-band signals of the respective sub-bands constituting the high band signals based on low band sub-band signals of the respective sub-bands constituting the low band signals and the extended or reduced coefficient table,

a high band signal production unit that produces the high band signals based on the high band sub-band powers and the low band sub-band signals, and

a synthesis unit that synthesizes the low band signal and the high band signal with each other to produce an output signal,

the method comprising the steps of causing:

the demultiplexing unit to demultiplex the encoded data;

the low band decoding unit to produce the low band signals;

the selection unit to select the coefficient table;

the extension and reduction unit to reduce or extend the coefficient table;

the high band sub-band power calculation unit to calculate the high band sub-band powers;

the high band signal production unit to produce the high band signals; and

the synthesis unit to produce the output signal,

wherein the extension and reduction unit duplicates the coefficients of a sub-band having a highest frequency which is included in the coefficient table and sets the duplicated coefficients to coefficients of a sub-band having a higher frequency than the highest frequency to extend the coefficient table.

16. The decoding method according to claim 15, wherein the extension and reduction unit deletes the coefficients of a sub-band, which has a higher frequency than that of a sub-band having a highest frequency among sub-bands of the high band sub-band signals, from the coefficient table to reduce the coefficient table.

~~13~~17. An encoder comprising:

a sub-band division unit that produces low band sub-band signals of a plurality of sub-bands on a low band side of an input signal and high band sub-band signals of a plurality of sub-bands on a high band side of the input signal;

an extension and reduction unit that deletes the coefficients of some sub-bands to reduce a coefficient table or produces coefficients of predetermined sub-bands based on coefficients of some sub-bands to extend a coefficient table, the coefficient table having coefficients for the respective sub-bands on the high band side;

a pseudo high band sub-band power calculation unit that calculates pseudo high band sub-band powers, which are estimated values of powers of the high band sub-band signals, for the respective sub-bands on the high band side based on the extended or reduced coefficient table and the low band sub-band signals;

a selection unit that compares high band sub-band powers of the high band sub-band signals and the pseudo high band sub-band powers to each other and selects one of a plurality of the coefficient tables;

a high band encoding unit that encodes coefficient information for obtaining the selected coefficient table to produce high band encoded data;

a low band encoding unit that encodes low band signals of the input signal to produce low band encoded data; and

a multiplexing unit that multiplexes the low band encoded data and the high band encoded data to produce an output code string,

wherein the extension and reduction unit duplicates the coefficients of a sub-band having a highest frequency which is included in the coefficient table and sets the duplicated coefficients to coefficients of a sub-band having a higher frequency than the highest frequency to extend the coefficient table.

18. The encoder according to claim 17, wherein the extension and reduction unit deletes the coefficients of a sub-band, which has a higher frequency than that of a sub-band having a highest frequency among sub-bands of the high band sub-band signals, from the coefficient table to reduce the coefficient table.

~~14~~19. An encoding method of an encoder which includes

a sub-band division unit that produces low band sub-band signals of a plurality of sub-bands on a low band side of an input signal and high band sub-band signals of a plurality of sub-bands on a high band side of the input signal,

an extension and reduction unit that deletes the coefficients of some sub-bands to reduce a coefficient table or produces coefficients of predetermined sub-bands based on coefficients of some sub-bands to extend a coefficient table, the coefficient table having coefficients for the respective sub-bands on the high band side,

a pseudo high band sub-band power calculation unit that calculates pseudo high band sub-band powers, which are estimated values of powers of the high band sub-band signals, for the respective sub-bands on the high band side based on the extended or reduced coefficient table and the low band sub-band signals,

a selection unit that compares high band sub-band powers of the high band sub-band signals and the pseudo high band sub-band powers to each other and selects one of a plurality of the coefficient tables,

a high band encoding unit that encodes coefficient information for obtaining the selected coefficient table to produce high band encoded data,

a low band encoding unit that encodes low band signals of the input signal to produce low band encoded data, and

a multiplexing unit that multiplexes the low band encoded data and the high band encoded data to produce an output code string,

the method comprising the steps of causing:

the sub-band division unit to produces the low band sub-band signals and the high band sub-band signals;

the extension and reduction unit to reduce or extend the coefficient table;

the pseudo high band sub-band power calculation unit to calculate the pseudo high band sub-band powers;

the selection unit to select the coefficient table;

the high band encoding unit to produce the high band encoded data;

the low band encoding unit to produce the low band encoded data; and

the multiplexing unit to produce the output code string,

wherein the extension and reduction unit duplicates the coefficients of a sub-band having a highest frequency which is included in the coefficient table and sets the duplicated coefficients to coefficients of a sub-band having a higher frequency than the highest frequency to extend the coefficient table.

20. The encoding method according to claim 19, wherein the extension and reduction unit deletes the coefficients of a sub-band, which has a higher frequency than that of a sub-band having a highest frequency among sub-bands of the high band sub-band signals, from the coefficient table to reduce the coefficient table.