SIGNAL PROCESSING METHOD AND DEVICE

[0001] This application claims priority to Chinese Patent Application No. 201410177234.3, filed with the Chinese Patent Office on April 29, 2014 and entitled "SIGNAL PROCESSING MTHOD AND DEVICE", which is incorporated herein by reference in its entirety.

TECHNICAL FIELD

[0002] The present invention relates to the signal processing field, and specifically, to a signal processing method and device.

BACKGROUND

[0003] In current communication transmission, increasing attention is paid to quality of a voice signal or an audio signal; therefore, a requirement for signal encoding and decoding is increasingly high. In an existing frequency domain encoding algorithm, bit allocation is generally performed on each sub-band of a signal directly according to a size of a frequency envelope, and then each sub-band is encoded by using a quantity of allocated bits. However, practice shows that, in these existing encoding algorithms, a sub-band of a low frequency band has relatively large impact on signal encoding quality; therefore, the sub-band of the low frequency band generally becomes a bottleneck of signal encoding performance. In addition, the foregoing bit allocation manner cannot well adapt to a bit requirement of each sub-band, especially that of a sub-band of a low frequency band, which leads to relatively poor signal encoding performance. Correspondingly, signal decoding performance is also relatively poor.

SUMMARY

[0004] Embodiments of the present invention provide a signal processing method and device, which can improve signal encoding and decoding performance.

[0005] According to a first aspect, a signal processing method is provided, including: selecting M sub-bands from N sub-bands, where the N sub-bands are obtained by dividing a spectral coefficient of a current frame of a signal, a frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, N is a positive integer greater than 1, both M and K are positive integers, and the sum of M and K is N; determining, according to performance information of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands, where the performance information is used to indicate an energy characteristic and a spectral characteristic that are of the M sub-bands; performing modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands; and performing first bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands.

[0006] With reference to the first aspect, in a first possible implementation manner, the determining, according to performance information of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands includes:

determining a first parameter according to original envelope values of the N sub-bands, where the first parameter indicates a concentration degree that is of spectral energy of the signal and that is on the M sub-bands;

determining a second parameter according to the original envelope values of the M sub-bands, where the second parameter indicates a degree of spectral fluctuation of the M sub-bands; and

determining, in a case in which the first parameter falls within a first range and the second parameter falls within a second range, to perform the modification operation on the original envelope values of the M sub-bands.

[0007] With reference to the first possible implementation manner of the first aspect, in a second possible implementation manner, the determining a first parameter according to original envelope values of the N sub-bands includes: determining total energy of the M sub-bands according to the original envelope values of the M sub-bands; determining total energy of the K sub-bands according to the original envelope values of the K sub-bands; and determining a ratio of the total energy of the M sub-bands to the total energy of the K sub-bands as the first parameter.

[0008] With reference to the first possible implementation manner or the second

possible implementation manner of the first aspect, in a third possible implementation manner, the determining a second parameter according to the original envelope values of the M sub-bands includes: determining the total energy of the M sub-bands and energy of a first sub-band according to the original envelope values of the M sub-bands, where the energy of the first sub-band is the largest in that of the M sub-bands; and determining a ratio of the energy of the first sub-band to the total energy of the M sub-bands as the second parameter.

[0009] With reference to the first aspect or any one of the foregoing implementation manners, in a fourth possible implementation manner, the performing modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands includes: determining the total energy of the M sub-bands and the energy of the first sub-band according to the original envelope values of the M sub-bands, where the energy of the first sub-band is the largest in that of the M sub-bands; determining a modification factor according to the total energy of the M sub-bands and the energy of the first sub-band; and performing modification separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

[0010] With reference to the first aspect or any one of the foregoing implementation manners, in a fifth possible implementation manner, a modified envelope value of each sub-band in the M sub-bands is greater than an original envelope value of the same sub-band.

[0011] With reference to the first aspect or any one of the foregoing implementation manners, in a sixth possible implementation manner, the method further includes: determining a quantity of redundant bits of each sub-band in the N sub-bands according to quantities of bits respectively allocated to the N sub-bands during the first bit allocation, where the quantity of redundant bits of each sub-band in the N sub-bands is less than a quantity of bits required for encoding a single information unit in the same sub-band; determining a total quantity of redundant bits according to the quantity of redundant bits of each sub-band in the N sub-bands; and performing second bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands, the original envelope values of the K sub-bands, and the total quantity of redundant bits.

[0012] According to a second aspect, a signal processing device is provided,

including: a selection unit, configured to select M sub-bands from N sub-bands, where the N sub-bands are obtained by dividing a spectral coefficient of a current frame of a signal, a frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, N is a positive integer greater than 1, both M and K are positive integers, and the sum of M and K is N; a determining unit, configured to determine, according to performance information of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands, where the performance information is used to indicate an energy characteristic and a spectral characteristic that are of the M sub-bands; a modification unit, configured to perform modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands; and an allocation unit, configured to perform first bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands.

[0013] With reference to the second aspect, in a first possible implementation manner, the determining unit is specifically configured to: determine a first parameter according to original envelope values of the N sub-bands, where the first parameter indicates a concentration degree that is of spectral energy of the signal and that is on the M sub-bands; determine a second parameter according to the original envelope values of the M sub-bands, where the second parameter indicates a degree of spectral fluctuation of the M sub-bands; and determine, in a case in which the first parameter falls within a first range and the second parameter falls within a second range, to perform the modification operation on the original envelope values of the M sub-bands.

[0014] With reference to the first possible implementation manner of the second aspect, in a second possible implementation manner, the determining unit is specifically configured to: determine total energy of the M sub-bands according to the original envelope values of the M sub-bands; determine total energy of the K sub-bands according to the original envelope values of the K sub-bands; and determine a ratio of the total energy of the M sub-bands to the total energy of the K sub-bands as the first parameter.

[0015] With reference to the first possible implementation manner or the second possible implementation manner of the second aspect, in a third possible implementation manner, the determining unit is specifically configured to: determine

the total energy of the M sub-bands and energy of a first sub-band according to the original envelope values of the M sub-bands, where the energy of the first sub-band is the largest in that of the M sub-bands; and determine a ratio of the energy of the first sub-band to the total energy of the M sub-bands as the second parameter.

[0016] With reference to the second aspect or any one of the foregoing implementation manners, in a fourth possible implementation manner, the modification unit is specifically configured to: determine the total energy of the M sub-bands and the energy of the first sub-band according to the original envelope values of the M sub-bands, where the energy of the first sub-band is the largest in that of the M sub-bands; determine a modification factor according to the total energy of the M sub-bands and the energy of the first sub-band; and perform modification separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

[0017] With reference to the second aspect or any one of the foregoing implementation manners, in a fifth possible implementation manner, a modified envelope value of each sub-band in the M sub-bands is greater than an original envelope value of the same sub-band.

[0018] With reference to the second aspect or any one of the foregoing implementation manners, in a sixth possible implementation manner, the determining unit is further configured to determine a quantity of redundant bits of each sub-band in the N sub-bands according to quantities of bits respectively allocated to the N sub-bands during the first bit allocation, where the quantity of redundant bits of each sub-band in the N sub-bands is less than a quantity of bits required for encoding a single information unit in the same sub-band; the determining unit is further configured to determine a total quantity of redundant bits according to the quantity of redundant bits of each sub-band in the N sub-bands; and the allocation unit is further configured to perform second bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands, the original envelope values of the K sub-bands, and the total quantity of redundant bits.

[0019] In the embodiments of the present invention, bit allocation is not directly performed according to original envelope values of N sub-bands; instead, M sub-bands of a low frequency band are selected from the N sub-bands, it is determined, according to an energy characteristic and a spectral characteristic that are of the M sub-bands, to perform a modification operation on original envelope values

of the M sub-bands, modification is performed separately on the original envelope values of the M sub-bands according to the original envelope values of the M sub-bands, and first bit allocation is performed on the N sub-bands according to modified envelope values of the M sub-bands and original envelope values of K sub-bands, so that bit allocation better meets a bit requirement of each sub-band, and therefore, signal encoding and decoding performance can be improved.

BRIEF DESCRIPTION OF DRAWINGS

[0020] To describe the technical solutions in the embodiments of the present invention more clearly, the following briefly describes the accompanying drawings required for describing the embodiments of the present invention. Apparently, the accompanying drawings in the following description show merely some embodiments of the present invention, and persons of ordinary skill in the art may still derive other drawings from these accompanying drawings without creative efforts.

[0021] FIG. 1 is a schematic flowchart of a signal processing method according to an embodiment of the present invention;

[0022] FIG. 2 is a schematic flowchart of a process of a signal processing method according to an embodiment of the present invention;

[0023] FIG. 3 is a schematic block diagram of a signal processing device according to an embodiment of the present invention; and

[0024] FIG. 4 is a schematic block diagram of a signal processing device according to another embodiment of the present invention.

DESCRIPTION OF EMBODIMENTS

[0025] The following clearly and completely describes the technical solutions in the embodiments of the present invention with reference to the accompanying drawings in the embodiments of the present invention. Apparently, the described embodiments are some but not all of the embodiments of the present invention. All other embodiments obtained by persons of ordinary skill in the art based on the embodiments of the present invention without creative efforts shall fall within the protection scope of the present invention.

[0026] A signal encoding technology and a signal decoding technology are widely

applied to various electronic devices, such as a mobile phone, a wireless apparatus, a personal data assistant (Personal Data Assistant, PDA), a handheld or portable computer, a Global Positioning System (Global Positioning System, GPS) receiver/navigation assistant, a camera, an audio/video player, a video camera, a video recorder, and a monitoring device. Generally, such electronic devices include a voice encoder or an audio encoder, and may further include a voice decoder or an audio decoder. The voice encoder or the audio encoder and the voice decoder or the audio decoder may be directly implemented by a digital circuit or a chip, such as a digital signal processing (Digital Signal Processor, DSP) chip, or may be implemented by a software code-driven processor by executing a procedure in software code.

[0027] FIG. 1 is a schematic flowchart of a signal processing method according to an embodiment of the present invention. The method in FIG. 1 is executed by an encoder side, such as the foregoing voice encoder or the foregoing audio encoder. The method in FIG. 1 may also be executed by a decoder side, such as the foregoing voice decoder or the foregoing audio decoder.

[0028] In an encoding process, the encoder side may first transform a time-domain signal into a frequency-domain signal. For example, time-frequency transformation may be performed by using an algorithm such as fast Fourier transform (Fast Fourier Transform, FFT) or modified discrete cosine transform (Modified Discrete Cosine Transform, MDCT). Then, a global gain may be used to perform normalization on a spectral coefficient of the frequency-domain signal, and division is performed on a normalized spectral coefficient so as to obtain multiple sub-bands.

[0029] In a decoding process, the decoder side may decode a bitstream received from the encoder side to obtain a normalized spectral coefficient, and division is performed on the normalized spectral coefficient so as to obtain multiple sub-bands.

[0030] 110. Select M sub-bands from N sub-bands, where the N sub-bands are obtained by dividing a spectral coefficient of a current frame of a signal, a frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, N is a positive integer greater than 1, both M and K are positive integers, and the sum of M and K is N.

[0031] In this embodiment of the present invention, the signal may be a voice signal, or may be an audio signal. The foregoing K sub-bands are all sub-bands in the N sub-bands except the M sub-bands.

[0032] 120. Determine, according to performance information of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands, where the performance information is used to indicate an energy characteristic and a spectral characteristic that are of the M sub-bands.

[0033] 130. Perform modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands.

[0034] 140. Perform first bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands.

[0035] In this embodiment of the present invention, bit allocation is not directly performed according to original envelope values of N sub-bands; instead, M sub-bands of a low frequency band are selected from the N sub-bands, it is determined, according to an energy characteristic and a spectral characteristic that are of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands, modification is performed separately on the original envelope values of the M sub-bands according to the original envelope values of the M sub-bands, and first bit allocation is performed on the N sub-bands according to modified envelope values of the M sub-bands and original envelope values of K sub-bands, so that bit allocation better meets a bit requirement of each sub-band, and therefore, signal encoding and decoding performance can be improved.

[0036] Specifically, in an existing frequency domain encoding algorithm, bit allocation is performed on each sub-band of a signal directly according to a size of a frequency envelope. As a result, a quantity of allocated bits cannot well meet a bit requirement of some sub-bands of a low frequency band. However, in this embodiment of the present invention, the M sub-bands of the low frequency band are first selected from the N sub-bands, it is determined, according to the energy characteristic and the spectral characteristic that are of the M sub-bands, to perform a modification operation on the original envelope values of the M sub-bands, modification is performed on the original envelope values of the M sub-bands according to the original envelope values of the N sub-bands, and then the first bit allocation is performed on the N sub-bands according to the modified envelope values of the M sub-bands and the original envelope values of the K sub-bands. It may be learned that, in this embodiment of the present invention, bit allocation is not directly performed on the N sub-bands according to the original envelope values of the N

sub-bands. Instead, the energy characteristic and the spectral characteristic that are of the M sub-bands are used as considerations to determine that modification needs to be performed on the M sub-bands, so as to obtain the respective modified envelope values of the M sub-bands, and bit allocation is performed according to the modified envelope values of the sub-bands of the low frequency band and original envelope values of other sub-bands, so that bit allocation performed on each sub-band is more proper, especially that performed on the M sub-bands of the low frequency band, and therefore, signal encoding and decoding performance can be improved.

[0037] After the spectral coefficient is divided to obtain the N sub-bands, an envelope of each sub-band may be calculated and quantized. Therefore, each sub-band has a quantized envelope value. It should be understood that an original envelope value is relative to a modified envelope value, and the original envelope value may refer to an initial envelope value of a sub-band, that is, a quantized envelope value obtained by calculation after sub-band division. An envelope value obtained after the initial envelope value of the sub-band is modified is referred to as the modified envelope value. Therefore, in this embodiment of the present invention, both the mentioned original envelope value and modified envelope value refer to quantized envelope values.

[0038] Optionally, as an embodiment, in step 110, the M sub-bands may be selected from the N sub-bands according to a harmonic characteristic of a sub-band and energy of a sub-band. For example, for the M sub-bands, harmonic strength of each sub-band may be greater than a preset strength threshold, and a ratio of energy of the sub-band to total energy of the N sub-bands is greater than a preset energy threshold. As mentioned above, sub-bands of a low frequency band are generally a bottleneck of signal encoding performance. In these sub-bands, a sub-band that has a relatively strong harmonic characteristic and whose energy accounts for a specific proportion of total energy of all sub-bands is particularly a bottleneck of encoding performance. Therefore, after the M sub-bands are selected from the N sub-bands according to the harmonic characteristic of the sub-band and the energy of the sub-band, and the original envelope values of the M sub-bands are modified, bit allocation performed on the M sub-bands is more proper, and therefore, signal encoding and decoding performance can be efficiently improved.

[0039] Optionally, as another embodiment, the N sub-bands may be arranged in ascending order of frequency bands. In this way, in step 110, the first M sub-bands

may be selected from the N sub-bands. In this embodiment, the M sub-bands are selected in ascending order of frequency bands, which can simplify an operation and improve signal processing efficiency.

[0040] Optionally, as another embodiment, in step 120, a first parameter may be determined according to the original envelope values of the N sub-bands, where the first parameter may indicate a concentration degree that is of spectral energy of the signal and that is on the M sub-bands. A second parameter may be determined according to the original envelope values of the M sub-bands, where the second parameter indicates a degree of spectral fluctuation of the M sub-bands. In a case in which the first parameter falls within a first range and the second parameter falls within a second range, it may be determined to perform a modification operation on the original envelope values of the M sub-bands.

[0041] Specifically, the energy characteristic of the M sub-bands may be the concentration degree that is of the spectral energy of the signal and that is on the M sub-bands, and the spectral characteristic of the M sub-bands may be the degree of spectral fluctuation of the M sub-bands.

[0042] The first range is related to energy of a sub-band, and may be preset. When the concentration degree that is of the spectral energy of the signal and that is on the M sub-bands is relatively low, it may indicate that a ratio of the M sub-bands to the N sub-bands is small, and the encoding performance is not greatly affected. Therefore, there is no need to modify the original envelope values of the M sub-bands. When the concentration degree that is of the spectral energy of the signal and that is on the M sub-bands is relatively high, it indicates that the original envelope values of the M sub-bands are also relatively large. Therefore, a quantity of bits allocated to the M sub-bands is enough for encoding, and there is also no need to modify the original envelope values of the M sub-bands. The first range may be predetermined by means of experimental simulation. For example, the first range may be preset to [1/6, 2/3].

[0043] The second range is related to a degree of spectral fluctuation of a sub-band, and may be preset. If the degree of spectral fluctuation of the M sub-bands is low, the encoding performance is not greatly affected even if the quantity of bits allocated to the M sub-band is small. In this way, there is no need to modify the original envelope values of the M sub-bands. Therefore, the second range indicates that the degree of spectral fluctuation of the sub-bands is relatively high. The second range may be predetermined by means of experimental simulation. For example, the

second range may be preset to $[\frac{1}{0.575*M}, \infty)$ or $[\frac{1}{0.5*M}, \infty)$. Generally, if in a signal, bandwidth that can be used for encoding is 0 to 4 KHz, the second range may be preset to $[\frac{1}{0.575*M}, \infty)$; if in a signal, bandwidth that can be used for encoding is 0 to 8 KHz, the second range may be preset to $[\frac{1}{0.5*M}, \infty)$.

[0044] When the first parameter falls within the first range and the second parameter falls within the second range, it means that the concentration degree that is of the spectral energy of the signal and that is on the M sub-bands is neither extremely high nor extremely low, and that the degree of spectral fluctuation of the M sub-bands is relatively high, and modification may be performed on the original envelope values of the M sub-bands, so that bits allocated to the M sub-bands during the first bit allocation of the M sub-bands better meet a bit requirement of the M sub-bands. For example, for each sub-band in the M sub-bands, a modified envelope value is greater than an original envelope value. Then, compared with performing first bit allocation according to the original envelope values of the M sub-bands, performing first bit allocation according to the modified envelope values of the M sub-bands makes a quantity of bits allocated to the M sub-bands be larger, and therefore, encoding performance of the M sub-bands can be improved.

[0045] It may be learned that, in this embodiment, the first parameter and the second parameter that are determined according to the original envelope values of the N sub-bands may reflect a characteristic of each frequency band. Therefore, in a case in which the first parameter falls within the first range and the second parameter falls within the second range, it is determined to perform a modification operation on the original envelope values of the M sub-bands, so that when bit allocation is subsequently performed according to the modified envelope values of the M sub-bands, a quantity of bits allocated to the M sub-bands better meets a bit requirement of the M sub-bands, and therefore, signal encoding and decoding performance can be improved.

[0046] Optionally, as another embodiment, in step 120, total energy of the M sub-bands may be determined according to the original envelope values of the M sub-bands. Total energy of the K sub-bands may be determined according to the original envelope values of the K sub-bands. A ratio of the total energy of the M

sub-bands to the total energy of the K sub-bands may be determined as the first parameter.

[0047] Specifically, the ratio of the total energy of the M sub-bands to the total energy of the K sub-bands may be determined as the first parameter. In this way,

[0048] For example, the first parameter may be obtained by calculation according to the following equations, where the first parameter may be represented by α:

$$\alpha = \frac{E_{P_M}}{E_{P_K}},$$

$$E_{P_M} = \sum_{i=0}^{M-1} E_{P_tmp_i}, \quad E_{P_K} = \sum_{i=M}^{N-M-1} E_{P_tmp_i},$$

$$E_{P_tmp_i} = \sqrt{\frac{E_{P_i}}{band_width_i}}, \text{ and } \quad E_{P_i} = 2^{band_energy_i}, \text{ where}$$

E_{p_M} may represent the total energy of the M sub-bands, E_{P_K} may represent the total energy of the K sub-bands, $band_width_i$ may represent bandwidth of the ith sub-band, and $band_energy_i$ may represent energy of the ith sub-band. $band_energy_i$ may represent an original envelope value of the ith sub-band. For example, the original envelope value $band_energy_i$ of the ith sub-band may be obtained according to a spectral coefficient of the ith sub-band. For example, $band_energy_i$ may be obtained according to the following equations:

$$band_energy_i = \log_2 E_i, \text{ and}$$

$$E_i = \sum_{i=1}^{band_width_i} t_audio[j] * t_audio[j].$$

[0049] It should be understood that persons skilled in the art can apparently make various equivalent modifications or changes according to the foregoing equations, to obtain the first parameter, and such modifications or changes also fall within a scope of this embodiment of the present invention.

[0050] Optionally, as another embodiment, in step 120, according to the original envelope values of the M sub-bands, total energy of the M sub-bands may be determined, and energy of a first sub-band may be determined, where the energy of the first sub-band is the largest in that of the M sub-bands. A ratio of the energy of the first sub-band to the total energy of the M sub-bands may be determined as the second parameter.

[0051] Specifically, the degree of spectral fluctuation of the M sub-bands may be indicated by using a fluctuation degree of the original envelope values of the M sub-bands. For example, the second parameter may be obtained by calculation according to the following equations, where the second parameter may be represented by β:

$$\beta = \frac{E_{P_peak}}{E_{P_M}}$$, and $$E_{P_peak} = \max(E_{p_tem_0}, E_{p_tmp_1}, \cdots E_{p_tmp_M})$$, where

for calculation manners of $E_{P_tmp_i}$ and E_{p_M}, reference may be made to the foregoing equations.

[0052] It should be understood that persons skilled in the art can apparently make various equivalent modifications or changes according to the foregoing equations, to obtain the second parameter, and such modifications or changes also fall within a scope of this embodiment of the present invention.

[0053] Optionally, as another embodiment, in step 130, total energy of the M sub-bands and energy of a first sub-band may be determined according to the original envelope values of the M sub-bands, where the energy of the first sub-band is the largest in that of the M sub-bands. A modification factor may be determined according to the total energy of the M sub-bands and the energy of the first sub-band. Then, modification may be performed separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

[0054] For example, the modification factor may be determined according to the following equations, where the modification factor may be represented by γ:

$$\gamma = \min(1.2, \gamma_0 * \frac{E_{P_peak} * M}{E_{P_M}})$$, and $$\gamma_0 = 0.575\ \gamma_0$$, where

for calculation manners of $E_{P_tmp_i}$ and E_{P_M}, reference may be made to the foregoing equations.

[0055] Modification may be performed on an original envelope value of each sub-band in the M sub-bands according to the modification factor γ. For example, the original envelope value of each sub-band may be multiplied by the modification factor, so as to obtain a modified envelope value of the sub-band.

[0056] It should be understood that persons skilled in the art can apparently make

various equivalent modifications or changes according to the foregoing equations, to obtain the modification factor, and such modifications or changes also fall within a scope of this embodiment of the present invention.

[0057] Optionally, as another embodiment, in step 130, a modified envelope value of each sub-band in the M sub-bands may be greater than an original envelope value of the sub-band.

[0058] Specifically, the modified envelope value of each sub-band in the M sub-bands is obtained by performing modification on the original envelope value of each sub-band in the M sub-bands. The modified envelope value of each sub-band may be greater than the original envelope value of the sub-band. If the modified envelope value of each sub-band in the M sub-bands is greater than the original envelope value of the sub-band, in step 140, bit allocation is performed according to the modified envelope values of the M sub-bands. In this way, a quantity of bits allocated to each sub-band in the M sub-bands increases, so that the bit allocation better meets a bit requirement of each sub-band, and therefore, signal encoding and decoding performance can be improved.

[0059] Optionally, as another embodiment, in step 130, a modified envelope value of each sub-band in the M sub-bands may be less than an original envelope value of the sub-band.

[0060] Specifically, if the modified envelope value of each sub-band in the M sub-bands may be less than the original envelope value of the sub-band, in step 140, bit allocation is performed according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands. In this way, a quantity of bits allocated to each sub-band in the M sub-bands is relatively small, and accordingly, quantities of bits respectively allocated to the K sub-bands increase, so that the bit allocation better meets a bit requirement of each sub-band, and therefore, signal encoding and decoding performance can be improved.

[0061] Optionally, as another embodiment, in step 130, first bit allocation may be performed on the N sub-bands in descending order of envelope values.

[0062] Optionally, as another embodiment, in step 120, a modification factor may be determined according to the second parameter. Then, modification may be performed separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

[0063] Specifically, the modification factor may be determined according to the

second parameter. Modification may be performed on an original envelope value of each sub-band in the M sub-bands according to the modification factor. For example, the original envelope value of each sub-band may be multiplied by the modification factor to obtain a modified envelope value of the sub-band, so that a quantity of bits allocated to the M sub-bands better meets a bit requirement of the M sub-bands, and therefore, signal encoding and decoding performance can be improved.

[0064] After the first bit allocation is performed, generally, there are redundant bits in a quantity of bits allocated to each sub-band. Redundant bits of each sub-band are not enough for encoding one information unit of the sub-band. Therefore, quantities of redundant bits of all sub-bands may be counted to obtain a total quantity of redundant bits, and then second bit allocation is performed.

[0065] Optionally, as another embodiment, after step 140, a quantity of redundant bits of each sub-band in the N sub-bands may be determined according to quantities of bits respectively allocated to the N sub-bands during the first bit allocation, where the quantity of redundant bits of each sub-band in the N sub-bands is less than a quantity of bits required for encoding in the same sub-band. A total quantity of redundant bits may be determined according to the quantity of redundant bits of each sub-band in the N sub-bands. Then, second bit allocation may be performed on the N sub-bands according to the total quantity of redundant bits.

[0066] Specifically, total redundant bits may be equally allocated to the N sub-bands. In this way, redundant bits may be reused, so as to avoid a waste of bits and further improve signal encoding and decoding performance.

[0067] The foregoing describes a process of first bit allocation and second bit allocation. If the foregoing method in FIG. 1 is executed by an encoder side, after the second bit allocation, the encoder side may quantize a spectral coefficient of each sub-band by using a quantity of bits allocated to each sub-band in a process of the two times bit allocation, write an index of a quantized spectral coefficient and an index of an original envelope value of each sub-band into a bitstream, and then send the bitstream to a decoder side.

[0068] If the foregoing method in FIG. 1 is executed by a decoder side, after the second bit allocation, the decoder side may decode a quantized spectral coefficient by using a quantity of bits allocated to each sub-band in a process of the two times bit allocation, so as to obtain a recovered signal.

[0069] The following describes embodiments of the present invention in detail

with reference to specific examples. It should be understood that, these examples are merely intended to help persons skilled in the art better understand the embodiments of the present invention, but are not intended to limit the scope of the embodiments of the present invention.

[0070] In the following examples, an encoder side is used as an example for description.

[0071] FIG. 2 is a schematic flowchart of a process of a signal processing method according to an embodiment of the present invention.

[0072] 201. An encoder side performs time-frequency transformation on a time-domain signal.

[0073] 202. The encoder side divides a spectral coefficient of a frequency-domain signal into N sub-bands, where N is a positive integer greater than 1.

[0074] Specifically, the encoder side may calculate a global gain; the global gain is used to perform normalization on an original spectral coefficient; then, division is performed on a normalized spectral coefficient so as to obtain all sub-bands.

[0075] 203. The encoder side obtains an original envelope value of each sub-band by means of a calculation operation and a quantization operation.

[0076] 204. The encoder side selects M sub-bands from the N sub-bands, where M is a positive integer.

[0077] A frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, where K is a positive integer, and the sum of K and M is N.

[0078] 205. The encoder side determines a first parameter according to original envelope values of the M sub-bands and original envelope values of K sub-bands.

[0079] The first parameter may indicate a concentration degree that is of spectral energy of the signal and that is on the M sub-bands. For example, a ratio of total energy of the M sub-bands to total energy of the K sub-bands may be used to indicate the first parameter. For a calculation manner of the first parameter, reference may be made to the calculation manner of the first parameter in the embodiment of FIG. 1, and details are not described again.

[0080] 206. The encoder side determines a second parameter according to the original envelope values of the M sub-bands.

[0081] The second parameter may indicate a degree of spectral fluctuation of the M sub-bands. For example, a ratio of energy of a first sub-band to the total energy of

the M sub-bands may be used to indicate the second parameter, where the energy of the first sub-band is the largest in that of the M sub-bands. For a calculation manner of the second parameter, reference may be made to the calculation manner of the second parameter in the embodiment of FIG. 1, and details are not described again.

[0082] 207. The encoder side determines whether the first parameter falls within a first range and the second parameter falls within a second range.

[0083] The first range and the second range may be preset. For example, the first range may be preset to [1/6, 2/3]. The second range may be preset to $[\frac{1}{0.575*M}, \infty)$ or $[\frac{1}{0.5*M}, \infty)$.

[0084] 208. If the encoder side determines that the first parameter falls within the first range and the second parameter falls within the second range in step 207, modify the original envelope values of the M sub-bands according to the original envelope values of the M sub-bands, so as to obtain modified envelope values of the M sub-bands.

[0085] Specifically, the encoder side may determine a modification factor according to the original envelope values of the M sub-bands. For a calculation manner of the modification factor, reference may be made to the process in the embodiment of FIG. 1, and details are not described again. The encoder side may perform modification on an original envelope value of each sub-band in the M sub-bands by using the modification factor, so as to obtain the modified envelope values of the M sub-bands. For example, a modified envelope value of each sub-band may be greater than the original envelope value of the sub-band.

[0086] 209. The encoder side performs first bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands and the original envelope values of the K sub-bands.

[0087] For example, the encoder side may perform first bit allocation on the N sub-bands in descending order of envelope values. For the M sub-bands, because the modified envelope value of each sub-band is greater than the original envelope value of the sub-band, compared with a quantity of allocated bits before modification, a quantity of bits allocated to each sub-band in the M sub-bands increases, so that bit allocation better meets a bit requirement of each sub-band, thereby improving signal encoding and decoding performance.

[0088] 210. The encoder side performs second bit allocation on the N sub-bands.

[0089] Specifically, the encoder side may determine a quantity of redundant bits of each sub-band according to a quantity of bits allocated to each sub-band in the N sub-bands after the first bit allocation and bandwidth of each sub-band, so as to determine a total quantity of redundant bits of the N sub-bands. Then, total redundant bits are equally allocated to the N sub-bands according to the total quantity of redundant bits.

[0090] 211. The encoder side quantizes a spectral coefficient of each sub-band according to a quantity of bits allocated to each sub-band in the N sub-bands.

[0091] 212. The encoder side writes a bitstream according to a quantized spectral coefficient obtained in step 211 and an original envelope value of each sub-band.

[0092] Specifically, the encoder side may write indexes of the quantized spectral coefficient, the original envelope value of each sub-band, and the like into the bitstream. For a specific process, reference may be made to the prior art, and details are not described herein again.

[0093] 213. If the encoder side determines that the first parameter falls outside the first range or the second parameter falls outside the second range in step 207, the encoder side performs first bit allocation on the N sub-bands according to original envelope values of the N sub-bands.

[0094] For example, the encoder side may perform first bit allocation on the N sub-bands in descending order of envelope values.

[0095] 214. The encoder side performs second bit allocation on the N sub-bands.

[0096] Specifically, the encoder side may determine a quantity of redundant bits of each sub-band according to a quantity of bits allocated to each sub-band in the N sub-bands after the first bit allocation and bandwidth of each sub-band, so as to determine a total quantity of redundant bits of the N sub-bands. Then, total redundant bits are equally allocated to the N sub-bands according to the total quantity of redundant bits.

[0097] 215. The encoder side quantizes a spectral coefficient of each sub-band according to a quantity of bits allocated to each sub-band in the N sub-bands.

[0098] 216. The encoder side writes a bitstream according to a quantized spectral coefficient obtained in step 215 and an original envelope value of each sub-band.

[0099] Specifically, the encoder side may write indexes of the quantized spectral coefficient, the original envelope value of each sub-band, and the like into the

bitstream. For a specific process, reference may be made to the prior art, and details are not described herein again.

[0100] In this embodiment of the present invention, in a case in which a first parameter falls within a first range and a second parameter falls within a second range, modification is performed on original envelope values of M sub-bands of a low frequency band according to the original envelope values of the M sub-bands, and first bit allocation is performed on N sub-bands according to modified envelope values of the M sub-bands and original envelope values of K sub-bands, so that bit allocation better meets a bit requirement of each sub-band, and therefore, signal encoding and decoding performance can be improved.

[0101] FIG. 3 is a schematic block diagram of a signal processing device according to an embodiment of the present invention. A device 300 in FIG. 3 may be an encoder side device or a decoder side device. The device 300 in FIG. 3 includes a selection unit 310, a determining unit 320, a modification unit 330, and an allocation unit 340.

[0102] The selection unit 310 selects M sub-bands from N sub-bands, where the N sub-bands are obtained by dividing a spectral coefficient of a current frame of a signal, a frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, N is a positive integer greater than 1, both M and K are positive integers, and the sum of M and K is N. The determining unit 320 determines, according to performance information of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands, where the performance information is used to indicate an energy characteristic and a spectral characteristic that are of the M sub-bands. The modification unit 330 performs modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands. The allocation unit 340 performs first bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands.

[0103] In this embodiment of the present invention, bit allocation is not directly performed according to original envelope values of N sub-bands; instead, M sub-bands of a low frequency band are selected from the N sub-bands, it is determined, according to an energy characteristic and a spectral characteristic that are of the M sub-bands, to perform a modification operation on original envelope values

of the M sub-bands, modification is performed separately on the original envelope values of the M sub-bands according to the original envelope values of the M sub-bands, and first bit allocation is performed on the N sub-bands according to modified envelope values of the M sub-bands and original envelope values of K sub-bands, so that bit allocation better meets a bit requirement of each sub-band, and therefore, signal encoding and decoding performance can be improved.

[0104] Optionally, as an embodiment, the determining unit 320 may determine a first parameter according to original envelope values of the N sub-bands, where the first parameter indicates a concentration degree that is of spectral energy of the signal and that is on the M sub-bands. The determining unit 320 may determine a second parameter according to the original envelope values of the M sub-bands, where the second parameter indicates a degree of spectral fluctuation of the M sub-bands. The determining unit 320 may determine, in a case in which the first parameter falls within a first range and the second parameter falls within a second range, to perform the modification operation on the original envelope values of the M sub-bands.

[0105] Optionally, as another embodiment, the determining unit 320 may determine total energy of the M sub-bands according to the original envelope values of the M sub-bands, may determine total energy of the K sub-bands according to the original envelope values of the K sub-bands, and may determine a ratio of the total energy of the M sub-bands to the total energy of the K sub-bands as the first parameter.

[0106] Optionally, as another embodiment, the determining unit 320 may determine total energy of the M sub-bands and energy of a first sub-band according to the original envelope values of the M sub-bands, where the energy of the first sub-band is the largest in that of the M sub-bands. The determining unit 320 may determine a ratio of the energy of the first sub-band to the total energy of the M sub-bands as the second parameter.

[0107] Optionally, as another embodiment, the modification unit 330 may determine total energy of the M sub-bands and energy of a first sub-band according to the original envelope values of the M sub-bands, where the energy of the first sub-band is the largest in that of the M sub-bands. The modification unit 330 may determine a modification factor according to the total energy of the M sub-bands and the energy of the first sub-band, and may perform modification separately on the original envelope values of the M sub-bands by using the modification factor, so as to

acquire the modified envelope values of the M sub-bands.

[0108] Optionally, as another embodiment, a modified envelope value of each sub-band in the M sub-bands may be greater than an original envelope value of the same sub-band.

[0109] Optionally, as another embodiment, the determining unit 320 may further determine a quantity of redundant bits of each sub-band in the N sub-bands according to quantities of bits respectively allocated to the N sub-bands during the first bit allocation, where the quantity of redundant bits of each sub-band in the N sub-bands is less than a quantity of bits required for encoding a single information unit in the same sub-band. The determining unit 320 may further determine a total quantity of redundant bits according to the quantity of redundant bits of each sub-band in the N sub-bands. The allocation unit 340 may further perform second bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands, the original envelope values of the K sub-bands, and the total quantity of redundant bits.

[0110] For other functions and operations of the device 300, reference may be made to the processes of the method embodiments in FIG. 1 and FIG. 2. To avoid repetition, details are not described herein again.

[0111] FIG. 4 is a schematic block diagram of a signal processing device according to another embodiment of the present invention. A device 400 in FIG. 4 may be an encoder side device or a decoder side device. The device 400 in FIG. 4 includes a memory 410 and a processor 420.

[0112] The memory 410 may include a random access memory, a flash memory, a read-only memory, a programmable read-only memory, a non-volatile memory, a register, or the like. The processor 420 may be a central processing unit (Central Processing Unit, CPU).

[0113] The memory 410 is configured to store an executable instruction. The processor 420 may execute the executable instruction stored in the memory 410, so as to: select M sub-bands from N sub-bands, where the N sub-bands are obtained by dividing a spectral coefficient of a current frame of a signal, a frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, N is a positive integer greater than 1, both M and K are positive integers, and the sum of M and K is N; determine, according to performance information of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands, where the performance information is used to

indicate an energy characteristic and a spectral characteristic that are of the M sub-bands; perform modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands; and perform first bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands.

[0114] In this embodiment of the present invention, bit allocation is not directly performed according to original envelope values of N sub-bands; instead, M sub-bands of a low frequency band are selected from the N sub-bands, it is determined, according to an energy characteristic and a spectral characteristic that are of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands, modification is performed separately on the original envelope values of the M sub-bands according to the original envelope values of the M sub-bands, and first bit allocation is performed on the N sub-bands according to modified envelope values of the M sub-bands and original envelope values of K sub-bands, so that bit allocation better meets a bit requirement of each sub-band, and therefore, signal encoding and decoding performance can be improved.

[0115] Optionally, as an embodiment, the processor 420 may determine a first parameter according to original envelope values of the N sub-bands, where the first parameter indicates a concentration degree that is of spectral energy of the signal and that is on the M sub-bands. The processor 420 may determine a second parameter according to the original envelope values of the M sub-bands, where the second parameter indicates a degree of spectral fluctuation of the M sub-bands. The processor 420 may determine, in a case in which the first parameter falls within a first range and the second parameter falls within a second range, to perform the modification operation on the original envelope values of the M sub-bands.

[0116] Optionally, as another embodiment, the processor 420 may determine total energy of the M sub-bands according to the original envelope values of the M sub-bands, may determine total energy of the K sub-bands according to the original envelope values of the K sub-bands, and may determine a ratio of the total energy of the M sub-bands to the total energy of the K sub-bands as the first parameter.

[0117] Optionally, as another embodiment, the processor 420 may determine total energy of the M sub-bands and energy of a first sub-band according to the original envelope values of the M sub-bands, where the energy of the first sub-band is the largest in that of the M sub-bands. The processor 420 may determine a ratio of the

energy of the first sub-band to the total energy of the M sub-bands as the second parameter.

[0118] Optionally, as another embodiment, the processor 420 may determine total energy of the M sub-bands and energy of a first sub-band according to the original envelope values of the M sub-bands, where the energy of the first sub-band is the largest in that of the M sub-bands. The processor 420 may determine a modification factor according to the total energy of the M sub-bands and the energy of the first sub-band, and may perform modification separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

[0119] Optionally, as another embodiment, a modified envelope value of each sub-band in the M sub-bands may be greater than an original envelope value of the same sub-band.

[0120] Optionally, as another embodiment, the processor 420 may further determine a quantity of redundant bits of each sub-band in the N sub-bands according to quantities of bits respectively allocated to the N sub-bands during the first bit allocation, where the quantity of redundant bits of each sub-band in the N sub-bands is less than a quantity of bits required for encoding a single information unit in the same sub-band. The processor 420 may further determine a total quantity of redundant bits according to the quantity of redundant bits of each sub-band in the N sub-bands. The processor 420 may further perform second bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands, the original envelope values of the K sub-bands, and the total quantity of redundant bits.

[0121] For other functions and operations of the device 400, reference may be made to the processes of the method embodiments in FIG. 1 and FIG. 2. To avoid repetition, details are not described herein again.

[0122] Persons of ordinary skill in the art may be aware that, in combination with the examples described in the embodiments disclosed in this specification, units and algorithm steps may be implemented by electronic hardware or a combination of computer software and electronic hardware. Whether the functions are performed by hardware or software depends on particular applications and design constraint conditions of the technical solutions. Persons skilled in the art may use different methods to implement the described functions for each particular application, but it should not be considered that the implementation goes beyond the scope of the

present invention.

[0123] It may be clearly understood by persons skilled in the art that, for the purpose of convenient and brief description, for a detailed working process of the foregoing system, apparatus, and unit, reference may be made to a corresponding process in the foregoing method embodiments, and details are not described herein again.

[0124] In the several embodiments provided in the present application, it should be understood that the disclosed system, apparatus, and method may be implemented in other manners. For example, the described apparatus embodiment is merely exemplary. For example, the unit division is merely logical function division and may be other division in actual implementation. For example, a plurality of units or components may be combined or integrated into another system, or some features may be ignored or not performed. In addition, the displayed or discussed mutual couplings or direct couplings or communication connections may be implemented by using some interfaces. The indirect couplings or communication connections between the apparatuses or units may be implemented in electronic, mechanical, or other forms.

[0125] The units described as separate parts may or may not be physically separate, and parts displayed as units may or may not be physical units, may be located in one position, or may be distributed on a plurality of network units. Some or all of the units may be selected according to actual needs to achieve the objectives of the solutions of the embodiments.

[0126] In addition, functional units in the embodiments of the present invention may be integrated into one processing unit, or each of the units may exist alone physically, or two or more units are integrated into one unit.

[0127] When the functions are implemented in the form of a software functional unit and sold or used as an independent product, the functions may be stored in a computer-readable storage medium. Based on such an understanding, the technical solutions of the present invention essentially, or the part contributing to the prior art, or some of the technical solutions may be implemented in a form of a software product. The computer software product is stored in a storage medium, and includes several instructions for instructing a computer device (which may be a personal computer, a server, a network device, or the like) to perform all or some of the steps of the methods described in the embodiments of the present invention. The foregoing

storage medium includes: any medium that can store program encode, such as a USB flash drive, a removable hard disk, a read-only memory (ROM, Read-Only Memory), a random access memory (RAM, Random Access Memory), a magnetic disk, or an optical disc.

[0128] The foregoing descriptions are merely specific implementation manners of the present invention, but are not intended to limit the protection scope of the present invention. Any variation or replacement readily figured out by persons skilled in the art within the technical scope disclosed in the present invention shall fall within the protection scope of the present invention. Therefore, the protection scope of the present invention shall be subject to the protection scope of the claims.

CLAIMS

What is claimed is:

1. A signal processing method, comprising:

selecting M sub-bands from N sub-bands, wherein the N sub-bands are obtained by dividing a spectral coefficient of a current frame of a signal, a frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, N is a positive integer greater than 1, both M and K are positive integers, and the sum of M and K is N;

determining, according to performance information of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands, wherein the performance information is used to indicate an energy characteristic and a spectral characteristic that are of the M sub-bands;

performing modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands; and

performing first bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands.

2. The method according to claim 1, wherein the determining, according to performance information of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands comprises:

determining a first parameter according to original envelope values of the N sub-bands, wherein the first parameter indicates a concentration degree that is of spectral energy of the signal and that is on the M sub-bands;

determining a second parameter according to the original envelope values of the M sub-bands, wherein the second parameter indicates a degree of spectral fluctuation of the M sub-bands; and

determining, in a case in which the first parameter falls within a first range and the second parameter falls within a second range, to perform the modification operation on the original envelope values of the M sub-bands.

3. The method according to claim 2, wherein the determining a first parameter according to original envelope values of the N sub-bands comprises:

determining total energy of the M sub-bands according to the original envelope values of the M sub-bands;

determining total energy of the K sub-bands according to the original envelope values of the K sub-bands; and

determining a ratio of the total energy of the M sub-bands to the total energy of the K sub-bands as the first parameter.

4. The method according to claim 2 or 3, wherein the determining a second parameter according to the original envelope values of the M sub-bands comprises:

determining the total energy of the M sub-bands and energy of a first sub-band according to the original envelope values of the M sub-bands, wherein the energy of the first sub-band is the largest in that of the M sub-bands; and

determining a ratio of the energy of the first sub-band to the total energy of the M sub-bands as the second parameter.

5. The method according to any one of claims 1 to 4, wherein the performing modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands comprises:

determining the total energy of the M sub-bands and the energy of the first sub-band according to the original envelope values of the M sub-bands, wherein the energy of the first sub-band is the largest in that of the M sub-bands;

determining a modification factor according to the total energy of the M sub-bands and the energy of the first sub-band; and

performing modification separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

6. The method according to any one of claims 1 to 5, wherein a modified envelope value of each sub-band in the M sub-bands is greater than an original envelope value of the same sub-band.

7. The method according to any one of claims 1 to 6, further comprising:

determining a quantity of redundant bits of each sub-band in the N sub-bands according to quantities of bits respectively allocated to the N sub-bands during the first bit allocation, wherein the quantity of redundant bits of each sub-band in the N sub-bands is less than a quantity of bits required for encoding a single information unit in the same sub-band;

determining a total quantity of redundant bits according to the quantity of redundant bits of each sub-band in the N sub-bands; and

performing second bit allocation on the N sub-bands according to the modified

envelope values of the M sub-bands, the original envelope values of the K sub-bands, and the total quantity of redundant bits.

8. A signal processing device, comprising:

a selection unit, configured to select M sub-bands from N sub-bands, wherein the N sub-bands are obtained by dividing a spectral coefficient of a current frame of a signal, a frequency band of the M sub-bands is lower than a frequency band of K sub-bands in the N sub-bands except the M sub-bands, N is a positive integer greater than 1, both M and K are positive integers, and the sum of M and K is N;

a determining unit, configured to determine, according to performance information of the M sub-bands, to perform a modification operation on original envelope values of the M sub-bands, wherein the performance information is used to indicate an energy characteristic and a spectral characteristic that are of the M sub-bands;

a modification unit, configured to perform modification separately on the original envelope values of the M sub-bands, so as to acquire modified envelope values of the M sub-bands; and

an allocation unit, configured to perform first bit allocation on the N sub-bands according to the modified envelope values of the M sub-bands and original envelope values of the K sub-bands.

9. The device according to claim 8, wherein the determining unit is specifically configured to:

determine a first parameter according to original envelope values of the N sub-bands, wherein the first parameter indicates a concentration degree that is of spectral energy of the signal and that is on the M sub-bands;

determine a second parameter according to the original envelope values of the M sub-bands, wherein the second parameter indicates a degree of spectral fluctuation of the M sub-bands; and

determine, in a case in which the first parameter falls within a first range and the second parameter falls within a second range, to perform the modification operation on the original envelope values of the M sub-bands.

10. The device according to claim 9, wherein the determining unit is specifically configured to:

determine total energy of the M sub-bands according to the original envelope values of the M sub-bands;

determine total energy of the K sub-bands according to the original envelope values of the K sub-bands; and

determine a ratio of the total energy of the M sub-bands to the total energy of the K sub-bands as the first parameter.

11. The device according to claim 9 or 10, wherein the determining unit is specifically configured to:

determine the total energy of the M sub-bands and energy of a first sub-band according to the original envelope values of the M sub-bands, wherein the energy of the first sub-band is the largest in that of the M sub-bands; and

determine a ratio of the energy of the first sub-band to the total energy of the M sub-bands as the second parameter.

12. The device according to any one of claims 8 to 11, wherein the modification unit is specifically configured to:

determine the total energy of the M sub-bands and the energy of the first sub-band according to the original envelope values of the M sub-bands, wherein the energy of the first sub-band is the largest in that of the M sub-bands;

determine a modification factor according to the total energy of the M sub-bands and the energy of the first sub-band; and

perform modification separately on the original envelope values of the M sub-bands by using the modification factor, so as to acquire the modified envelope values of the M sub-bands.

13. The device according to any one of claims 8 to 12, wherein a modified envelope value of each sub-band in the M sub-bands is greater than an original envelope value of the same sub-band.

14. The device according to any one of claims 8 to 13, wherein:

the determining unit is further configured to determine a quantity of redundant bits of each sub-band in the N sub-bands according to quantities of bits respectively allocated to the N sub-bands during the first bit allocation, wherein the quantity of redundant bits of each sub-band in the N sub-bands is less than a quantity of bits required for encoding a single information unit in the same sub-band;

the determining unit is further configured to determine a total quantity of redundant bits according to the quantity of redundant bits of each sub-band in the N sub-bands; and

the allocation unit is further configured to perform second bit allocation on the N

sub-bands according to the modified envelope values of the M sub-bands, the original envelope values of the K sub-bands, and the total quantity of redundant bits.