rest bits, a feature of the signal is generally not considered, and bit allocation is uniformly performed on the frequency domain signal, which leads to a poor coding effect for some frequency domain signals. In an existing decoder for an audio signal, the frequency domain signal is restored by simply using the decoding technology corresponding to the coding technology, noise is filled into a frequency domain signal that is not obtained by decoding, and then frequency domain inverse transformation and time domain synthesis processing are performed to obtain the output signal. Extra noise is introduced when the noise is filled into some signals, which reduces the quality of the output signal.

Therefore, an existing solution of performing uniform bit allocation in a frequency domain coding algorithm leads to a poor coding effect for some signals; and the foregoing noise filling processing in an existing frequency domain decoding algorithm reduces the quality of the output signal.

SUMMARY

Embodiments of the present invention provide signal coding and decoding methods and devices, where, during coding, bit allocation for a frequency domain signal can be optimized, so as to achieve a better coding effect by using the same number of bits, and during decoding, a frequency domain excitation signal can be extended under the guidance of information obtained by ~~decoding by~~ frequency domain decoding, so as to achieve a better effect of an output signal.

According to one aspect, a signal coding method is provided, where the method includes: obtaining a frequency domain signal according to an input signal; allocating predetermined bits to the frequency domain signal according to a predetermined allocation rule; adjusting the bit allocation for the frequency domain signal when a highest frequency of the frequency domain signal to which bits are allocated is greater than a predetermined value; and coding the frequency domain signal according to the bit allocation for the frequency domain signal.

According to another aspect, a signal decoding method is provided, where the method includes: obtaining, from a received bit stream, a frequency domain signal obtained by decoding; when the frequency domain signal obtained by decoding meets a predetermined condition, predicting, according to the frequency domain signal obtained by decoding, a frequency domain signal that is not obtained by decoding; and obtaining, according to the frequency domain signal obtained by decoding and the predicted frequency domain signal ~~that is not obtained by decoding~~, a time domain signal that is finally outputted.

According to still another aspect, a signal coding device is provided, where the device

includes: a frequency domain transformation unit, which obtains a frequency domain signal according to an input signal; a bit allocation unit, which allocates predetermined bits to the frequency domain signal according to a predetermined allocation rule; a bit adjustment unit, which adjusts the bit allocation for the frequency domain signal when a highest frequency of the frequency domain signal to which bits are allocated is greater than or equal to a predetermined value; and a frequency domain coding unit, which codes the frequency domain signal according to the bit allocation for the frequency domain signal.

According to still another aspect, a signal decoding device is provided, where the device includes: a decoding unit, which obtains, from a received bit stream, a frequency domain signal obtained by decoding; a bandwidth extension unit, configured to predict a frequency domain signal that is not obtained by decoding, and when the frequency domain signal obtained by decoding meets a predetermined condition, predict, according to the frequency domain signal obtained by decoding, the frequency domain signal that is not obtained by decoding; and an output unit, which obtains, according to the frequency domain signal obtained by decoding and the predicted frequency domain signal, a time domain signal that is finally outputted.

In the foregoing technical solutions of the embodiments of the present invention, during coding, bit allocation for a frequency domain signal is adjusted according to a highest frequency of the frequency domain signal to which bits are allocated, so that a better coding effect is achieved when frequency domain coding is performed by using the same number of bits; and during decoding, a frequency domain signal that is not obtained by decoding is set under the guidance of the frequency domain signal obtained by decoding, so as to achieve a better effect of an output signal.

BRIEF DESCRIPTION OF DRAWINGS

To describe the technical solutions in the embodiments of the present invention more clearly, the following briefly introduces accompanying drawings required for describing the embodiments or the prior art. Apparently, the accompanying drawings in the following description show merely some embodiments of the present invention, and a person of ordinary skill in the art may still derive other drawings from these accompanying drawings without creative efforts.

FIG. 1 shows a signal coding method according to an embodiment of the present invention;

FIG. 2 shows a time-frequency joint coding method using a coding method in an embodiment of the present invention;

includes: a frequency domain transformation unit, which obtains a frequency domain signal according to an input signal; a bit allocation unit, which allocates predetermined bits to the frequency domain signal according to a predetermined allocation rule; a bit adjustment unit, which adjusts the bit allocation for the frequency domain signal when a highest frequency of the frequency domain signal to which bits are allocated is greater than or equal to a predetermined value; and a frequency domain coding unit, which codes the frequency domain signal according to the bit allocation for the frequency domain signal.

According to still another aspect, a signal decoding device is provided, where the device includes: a decoding unit, which obtains, from a received bit stream, a frequency domain signal obtained by decoding; a bandwidth extension unit, configured to predict a frequency domain signal that is not obtained by decoding, and when the frequency domain signal obtained by decoding meets a predetermined condition, predict, according to the frequency domain signal obtained by decoding, the frequency domain signal that is not obtained by decoding; and an output unit, which obtains, according to the frequency domain signal obtained by decoding and the predicted frequency domain signal, a time domain signal that is finally outputted.

According to a first aspect of the present invention, a signal coding method comprises:

obtaining a frequency domain signal according to an input signal;

allocating predetermined bits to the frequency domain signal according to a predetermined allocation rule;

adjusting the bit allocation for the frequency domain signal when a highest frequency of the frequency domain signal to which bits are allocated is greater than a predetermined value; and

coding the frequency domain signal according to the bit allocation for the frequency domain signal.

In a first possible implementation manner of the first aspect, wherein the adjusting the bit allocation for the frequency domain signal comprises: reducing the number of bits allocated to a frequency band to which more bits are allocated in the frequency domain signal, and increasing the number of bits allocated to the highest frequency to which bits are allocated and a frequency domain signal near the highest frequency.

In a second possible implementation manner of the first aspect, wherein the predetermined value is determined according to the number of the predetermined bits and a resolution of the frequency domain signal.

In a third possible implementation manner of the first aspect, wherein the predetermined allocation rule is that: more bits in the predetermined bits are allocated to a low frequency band signal in the frequency domain signal, and rest bits in the predetermined bits are allocated to a frequency band with greater energy except the low frequency band signal.

In a fourth possible implementation manner of the first aspect, further comprising:

if the highest frequency is less than the predetermined value, maintaining the bit allocation for the frequency domain signal that is performed according to the predetermined allocation rule.

According to a second aspect of the present invention, a signal decoding method comprises:

obtaining, from a received bit stream, a frequency domain signal obtained by decoding;

when the frequency domain signal obtained by decoding meets a predetermined condition, predicting, according to the frequency domain signal obtained by decoding, a frequency domain signal that is not obtained by decoding; and

obtaining, according to the frequency domain signal obtained by decoding and the predicted frequency domain signal, a time domain signal that is finally outputted.

In a first possible implementation manner of the second aspect, wherein that the frequency domain signal obtained by decoding meets at least one of the following conditions:

a highest frequency of the frequency domain signal obtained by decoding is greater than a predetermined value; and

the frequency domain signal obtained by decoding comprises a time domain coding signal on which frequency domain transformation is performed and that contributes to an output signal.

With reference to the second aspect or the first possible implementation manner of the second aspect, in a second possible implementation manner of the second aspect, wherein the step of obtaining, from a received bit stream, a frequency domain signal obtained by decoding comprises:

performing frequency domain decoding on frequency domain information in the bit stream to obtain a first frequency domain signal;

determining, according to the first frequency domain signal, whether a time domain coding signal that contributes to the output signal exists in the bit stream; and

when it is determined that a time domain coding signal that contributes to the

output signal exists in the bit stream, performing time domain decoding and frequency domain transformation on the time domain coding signal to obtain a second frequency domain signal, and synthesizing the first frequency domain signal and the second frequency domain signal to obtain the frequency domain signal obtained by decoding.

With reference to the first possible implementation manner of the second aspect, in a third possible implementation manner of the second aspect, wherein the predetermined value is determined according to the number of predetermined bits used for frequency domain coding and a resolution of the frequency domain signal obtained by decoding.

In a fourth possible implementation manner of the second aspect, wherein the predicting, according to the frequency domain signal obtained by decoding, a frequency domain signal that is not obtained by decoding comprises: selecting a frequency domain signal in a frequency band from the frequency domain signal obtained by decoding, and predicting, according to the selected frequency domain signal, the frequency domain signal that is not obtained by decoding.

In a fifth possible implementation manner of the second aspect, wherein the predicting a frequency domain signal that is not obtained by decoding comprises: estimating a resonant peak location of the frequency domain signal according to a line spectral frequency, LSF, or an immittance spectral frequency ISF, and when an amplitude of a predicted frequency domain coefficient near the resonant peak location is greater than a threshold, reducing the amplitude of the predicted frequency domain coefficient near the resonant peak location.

In a sixth possible implementation manner of the second aspect, wherein when the frequency domain signal obtained by decoding does not meet the predetermined condition, the frequency domain signal that is not obtained by decoding is predicted by using noise.

According to a second aspect of the present invention, a signal coding device comprises:

a frequency domain transformation unit, configured to obtain a frequency domain signal according to an input signal;

a bit allocation unit, configured to allocate predetermined bits to the frequency domain signal according to a predetermined allocation rule; and

a bit adjustment unit, configured to adjust the bit allocation for the frequency domain signal when a highest frequency of the frequency domain signal to which bits are allocated is greater than or equal to a predetermined value; and

a frequency domain coding unit, configured to code the frequency domain signal

according to the bit allocation for the frequency domain signal.

In a first possible implementation manner of the third aspect, wherein the bit adjustment unit configured to adjust the bit allocation for the frequency domain signal by reducing the number of bits allocated to a frequency band to which more bits are allocated in the frequency domain signal, and increasing the number of bits allocated to the highest frequency to which bits are allocated and a frequency domain signal near the highest frequency.

In a second possible implementation manner of the third aspect, wherein the predetermined value is determined according to the number of the predetermined bits and a resolution of the frequency domain signal.

In a third possible implementation manner of the third aspect, wherein the predetermined allocation rule is that: more bits in the predetermined bits are allocated to a low frequency band signal in the frequency domain signal, and rest bits in the predetermined bits are allocated to a frequency band with greater energy except the low frequency band signal.

In a fourth possible implementation manner of the third aspect, wherein when the highest frequency is less than the predetermined value, the bit adjustment unit configured to not adjust the bit allocation for the frequency domain signal, and the frequency domain coding unit codes the frequency domain signal according to the bit allocation that is performed by the bit allocation unit.

According to a fourth aspect of the present invention, a signal decoding device comprises:

a decoding unit, configured to obtain, from a received bit stream, a frequency domain signal obtained by decoding;

a bandwidth extension unit, configured to predict, according to the frequency domain signal obtained by decoding, the frequency domain signal that is not obtained by decoding when the frequency domain signal obtained by decoding meets a predetermined condition; and

an output unit, configured to obtain, according to the frequency domain signal obtained by decoding and the predicted frequency domain signal, a time domain signal that is finally outputted.

In a first possible implementation manner of the fourth aspect, wherein that the frequency domain signal obtained by decoding meets at least one of the following: a highest frequency of the frequency domain signal obtained by decoding is greater than a

predetermined value, and the frequency domain signal obtained by decoding comprises a time domain coding signal on which frequency domain transformation is performed and that contributes to an output signal.

With reference to the fourth aspect or the first possible implementation manner of the fourth aspect, in a second possible implementation manner of the fourth aspect, wherein the decoding unit obtains, from the received bit stream by performing the following operations, the frequency domain signal obtained by decoding:

performing frequency domain decoding on frequency domain information in the bit stream to obtain a first frequency domain signal;

determining, according to the first frequency domain signal, whether a time domain coding signal that contributes to the output signal exists in the bit stream; and

when it is determined that a time domain coding signal that contributes to the output signal exists in the bit stream, performing time domain decoding and frequency domain transformation on the time domain coding signal to obtain a second frequency domain signal, and synthesizing the first frequency domain signal and the second frequency domain signal to obtain the frequency domain signal obtained by decoding.

With reference to the first possible implementation manner of the fourth aspect, in a third possible implementation manner of the fourth aspect, wherein the predetermined value is determined according to the number of predetermined bits used for frequency domain coding and a resolution of the frequency domain signal obtained by decoding.

In a fourth possible implementation manner of the fourth aspect, wherein when the frequency domain signal obtained by decoding meets the predetermined condition, the bandwidth extension unit selects a frequency domain signal in a frequency band from the frequency domain signal obtained by decoding, and predicts, according to the selected frequency domain signal, the frequency domain signal that is not obtained by decoding.

In a fifth possible implementation manner of the fourth aspect, wherein after predicting, according to the frequency domain signal obtained by decoding, the frequency domain signal that is not obtained by decoding, the bandwidth extension unit estimates a resonant peak location of the frequency domain signal according to a line spectral frequency LSF or an immittance spectral frequency ISF, and when an amplitude of a predicted frequency domain coefficient near the resonant peak location is greater than a threshold, reduces the amplitude of the predicted frequency domain coefficient near the resonant peak location.

In a sixth possible implementation manner of the fourth aspect, wherein when the

frequency domain signal obtained by decoding does not meet the predetermined condition, the bandwidth extension unit predicts, by using noise, the frequency domain signal that is not obtained by decoding.

In the foregoing technical solutions of the embodiments of the present invention, during coding, bit allocation for a frequency domain signal is adjusted according to a highest frequency of the frequency domain signal to which bits are allocated, so that a better coding effect is achieved when frequency domain coding is performed by using the same number of bits; and during decoding, a frequency domain signal that is not obtained by decoding is set under the guidance of the frequency domain signal obtained by decoding, so as to achieve a better effect of an output signal.

BRIEF DESCRIPTION OF DRAWINGS

To describe the technical solutions in the embodiments of the present invention more clearly, the following briefly introduces accompanying drawings required for describing the embodiments or the prior art. Apparently, the accompanying drawings in the following description show merely some embodiments of the present invention, and a person of ordinary skill in the art may still derive other drawings from these accompanying drawings without creative efforts.

FIG. 1 shows a signal coding method according to an embodiment of the present invention;

FIG. 2 shows a time-frequency joint coding method using a coding method in an embodiment of the present invention;

frequency domain signal.

260: Multiplex the coded frequency domain signal and the coded second time domain signal into the bit stream.

It should be noted that, besides including the difference signal f_diff, the frequency domain signal on which the frequency domain coding needs to be performed may further include another signal, such as a flag (flag) indicating whether the adaptive codebook contribution contributes to the output signal. Similarly, besides including the adaptive codebook contribution exc_pit, the second time domain signal on which the time domain coding needs to be performed may further include other information required for decoding.

In the foregoing time-frequency joint coding that is described with reference to FIG. 2, bit allocation for a frequency domain signal is adjusted according to a highest frequency of the frequency domain signal to which bits are allocated, which is combined with time domain coding, so that a better coding effect is achieved.

FIG. 3 shows a signal decoding method 300 according to an embodiment of the present invention. The method 300 includes:

310: Obtain, from a received bit stream, a frequency domain signal obtained by decoding. When only frequency domain coding is used, by using a frequency domain decoding method corresponding to a frequency domain coding method, the frequency domain signal obtained by decoding is obtained from the received bit stream. In the case of time-frequency joint coding, the frequency domain signal obtained by decoding is obtained from the received bit stream by performing the following operations: performing frequency domain decoding on frequency domain information in the bit stream to obtain a first frequency domain signal; determining, according to the first frequency domain signal, whether a time domain coding signal that contributes to an output signal exists in the bit stream; when it is determined that a time domain coding signal that contributes to the output signal exists in the bit stream, performing time domain decoding and frequency domain transformation on the time domain coding signal to obtain a second frequency domain signal, and synthesizing the first frequency domain signal and the second frequency domain signal to obtain the frequency domain signal obtained by decoding. This is further described below in detail with reference to FIG. 4.

320: When the frequency domain signal obtained by decoding meets a predetermined condition, predict, according to the frequency domain signal obtained by decoding, a frequency domain signal that is not obtained by decoding. As an example, that the frequency domain signal obtained by decoding meets a predetermined condition includes at least one of the following: a highest frequency of the frequency domain signal obtained by decoding is greater than a

predetermined value, and the frequency domain signal obtained by decoding includes a time domain coding signal on which the frequency domain transformation is performed and that contributes to an output signal. It should be noted that, in practice, a determining condition that the frequency domain signal obtained by decoding includes a time domain coding signal on which the frequency domain transformation is performed and that contributes to an output signal may be applied first, and then a determining condition that a highest frequency of the frequency domain signal obtained by decoding is greater than a predetermined value is applied; or an inverse sequence is used, or only one of the two may be used.

As described above with reference to 130 in FIG. 1, the predetermined value is determined according to the number tot_bit of predetermined bits used for the frequency domain coding and a resolution of the frequency domain signal. According to a requirement of practice, the predetermined value may be set to a frequency value that is a certain frequency less than a value of the highest frequency of the frequency domain signal. When the frequency domain signal is divided into sub-bands, the predetermined value may be an index number of a sub-band, and the highest frequency of the frequency domain signal to which bits are allocated is also represented by using an index number of a sub-band in which the highest frequency domain is located. A value of the predetermined value at a decoding end may be the same as or may be different from a value of the predetermined value at a coding end.

In the case of the time-frequency joint coding, the frequency domain signal obtained by decoding, which is obtained by decoding the bit stream in 310, possibly includes the time domain coding signal on which the frequency domain transformation is performed and that contributes to the output signal, and the time domain coding signal on which the frequency domain transformation is performed and that contributes to the output signal, for example, is a signal that is obtained by performing the time domain decoding and the frequency domain transformation on time domain coding information included in the bit stream, such as an adaptive codebook contribution. According to different types of coded signals and when a time domain analysis method used during the coding is not an LPC analysis, the time domain coding signal on which the frequency domain transformation is performed and that contributes to the output signal may also be another signal except the adaptive codebook contribution.

When the frequency domain signal obtained by decoding includes the adaptive codebook contribution, it may be learned, according to a flag (flag) indicating whether the foregoing adaptive codebook contribution contributes to the output signal, whether the frequency domain signal obtained by decoding includes the time domain coding signal on which the frequency domain transformation is performed and that contributes to the output signal. The frequency domain signal

During decoding at a receive end, when the bit stream is received, the bit stream is de-multiplexed into the first group of bits and the second group of bits by using a de-multiplexing technology corresponding to a multiplexing technology in 260 in FIG. 2. The first group of bits includes frequency domain information on which the following frequency domain decoding needs to be performed, and the second group of bits includes a time domain coding signal on which the following time domain decoding needs to be performed and that contributes to an output signal.

For time domain joint decoding of an audio signal, the first group of bits, for example, includes a difference signal f_diff, a flag (flag) indicating whether an adaptive codebook contribution contributes to an output signal, and the like. The second group of bits, for example, includes the adaptive codebook contribution when the adaptive codebook contribution contributes to the output signal. It should be noted that, when encoding the first group of bits and the second group of bits and signal,another signal may further be encoded correspondingly.

412: Perform the frequency domain decoding on the first group of bits to obtain a first frequency domain signal, and determine, according to the first frequency domain signal, whether a time domain coding signal that contributes to the output signal exists in the bit stream. The first group of bits is decoded by using a decoding method corresponding to a frequency domain coding method at a coding end, to obtain the first frequency domain signal. The first frequency domain signal, for example, includes a decoded difference signal f_diff, and the flag (flag) indicating whether the adaptive codebook contribution contributes to the output signal.

413: Perform the time domain decoding on the second group of bits. The second group of bits is decoded by using a decoding method corresponding to a time domain coding method at the coding end, to obtain a decoded time domain signal. Specifically, when it is determined that a time domain coding signal that contributes to the output signal exists in the bit stream, the time domain decoding is performed on the time domain coding signal in the second group of bits.

414: Perform frequency domain transformation on the adaptive codebook contribution in the decoded time domain signal, to obtain a second frequency domain signal.

415: Synthesize the first frequency domain signal and the second frequency domain signal to obtain the frequency domain signal obtained by decoding. As an example, when the adaptive codebook contribution contributes to the output signal, the frequency domain signal is obtained through synthesis by adding the difference signal f_diff in the first frequency domain signal and the adaptive codebook contribution in the second frequency domain signal. When the adaptive codebook contribution does not contribute to the output signal, the difference signal f_diff in the first frequency domain signal is directly used as the frequency domain signal.

After the frequency domain signal obtained by decoding is obtained, a time domain

frequency domain signal according to a predetermined allocation rule; a bit adjustment unit 730, which adjusts the bit allocation for the frequency domain signal when a highest frequency of the frequency domain signal to which bits are allocated is greater than or equal to a predetermined value; a frequency domain coding unit 740, which codes the frequency domain signal according to the bit allocation that has been adjusted; a time domain coding unit 750, which codes the second time domain signal; and a bit multiplexing unit 760, which multiplexes a coded frequency domain signal and a coded second time domain signal into a bit stream.

The bit allocation unit 720, the bit adjustment unit 730, and the frequency domain coding unit 740 in FIG. 7 are respectively the same as the bit allocation unit 620, the bit adjustment unit 630, and the frequency domain coding unit 640 in FIG. 6. Differences between FIG. 7 and FIG. 6 lie in that, the time domain coding unit 750 and the bit multiplexing unit 760 are added, and the frequency domain transformation unit 610 in FIG. 6 is replaced by the time domain analysis unit 711 and the frequency domain transformation unit 712. The following describes the differences between FIG. 7 and FIG. 6, and does not describe the content in common again.

The time domain analysis unit 711 obtains the first time domain signal and the second time domain signal by performing the time domain analysis on the input signal. For example, an LPC analysis and processing are performed on the input signal to obtain an ISF parameter (or an LSF parameter), a residual signal res, and an adaptive codebook contribution exc_pit. The residual signal res and the adaptive codebook contribution exc_pit are used as the first time domain signal, and the adaptive codebook contribution exc_pit is used as the second time domain signal.

The frequency domain transformation unit 712 may obtain the frequency domain signal by performing the frequency domain transformation and processing on the first time domain signal. As an example, the frequency domain transformation is performed separately on the residual signal res and the adaptive codebook contribution exc_pit in the first time domain signal, and then it is determined, according to relevance between a residual signal f_res of a frequency domain and an adaptive codebook contribution f_exc_pit of the frequency domain, whether the adaptive codebook contribution contributes to an output signal. If the adaptive codebook contribution contributes to the output signal, the adaptive codebook contribution f_exc_pit of the frequency domain is subtracted from the residual signal f_res of the frequency domain, to obtain a difference signal f_diff of the frequency domain, and the difference signal f_diff is included in the frequency domain signal. If the adaptive codebook contribution does not contribute to the output signal, the residual signal f_res of the frequency domain is directly used as the difference signal f_diff and is transmitted as the frequency domain signal. Besides including the difference signal f_diff, the frequency domain signal may further include another signal, for example, a flag (flag) indicating whether the adaptive

CLAIMS

What is claimed is:

1. A signal coding method, wherein the method comprises:

obtaining a frequency domain signal according to an input signal;

allocating predetermined bits to the frequency domain signal according to a predetermined allocation rule;

adjusting the bit allocation for the frequency domain signal when a highest frequency of the frequency domain signal to which bits are allocated is greater than a predetermined value; and

coding the frequency domain signal according to the bit allocation for the frequency domain signal.

2. The method according to claim 1, wherein the adjusting the bit allocation for the frequency domain signal comprises: reducing the number of bits allocated to a frequency band to which more bits are allocated in the frequency domain signal, and increasing the number of bits allocated to the highest frequency to which bits are allocated and its nearby frequency domain signal.

3. The method according to claim 1, wherein the predetermined value is determined according to the number of the predetermined bits and a resolution of the frequency domain signal.

4. The method according to claim 1, wherein the predetermined allocation rule is that: more bits in the predetermined bits are allocated to a low frequency band signal in the frequency domain signal, and rest bits in the predetermined bits are allocated to a frequency band with greater energy except the low frequency band signal.

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

if the highest frequency is less than the predetermined value, maintaining the bit allocation for the frequency domain signal that is performed according to the predetermined allocation rule.

6. A signal decoding method, wherein the method comprises:

obtaining, from a received bit stream, a frequency domain signal obtained by decoding;

when the frequency domain signal obtained by decoding meets a predetermined condition, predicting, according to the frequency domain signal obtained by decoding, a frequency domain signal that is not obtained by decoding; and

obtaining, according to the frequency domain signal obtained by decoding and the predicted frequency domain signal, a time domain signal that is finally outputted.

7. The method according to claim 6, wherein that the frequency domain signal obtained by decoding meets a predetermined condition comprises that at least one of the following conditions is

met:

a highest frequency of the frequency domain signal obtained by decoding is greater than a predetermined value; and

the frequency domain signal obtained by decoding comprises a time domain coding signal on which frequency domain transformation is performed and that contributes to an output signal.

8. The method according to claim 6 or 7, wherein the step of obtaining, from a received bit stream, a frequency domain signal obtained by decoding comprises:

performing frequency domain decoding on frequency domain information in the bit stream to obtain a first frequency domain signal;

determining, according to the first frequency domain signal, whether a time domain coding signal that contributes to the output signal exists in the bit stream; and

when it is determined that a time domain coding signal that contributes to the output signal exists in the bit stream, performing time domain decoding and frequency domain transformation on the time domain coding signal to obtain a second frequency domain signal, and synthesizing the first frequency domain signal and the second frequency domain signal to obtain the frequency domain signal obtained by decoding.

9. The method according to claim 7, wherein the predetermined value is determined according to the number of predetermined bits used for frequency domain coding and a resolution of the frequency domain signal obtained by decoding.

10. The method according to claim 6, wherein the predicting, according to the frequency domain signal obtained by decoding, a frequency domain signal that is not obtained by decoding comprises: selecting a frequency domain signal in a frequency band from the frequency domain signal obtained by decoding, and predicting, according to the selected frequency domain signal, the frequency domain signal that is not obtained by decoding.

11. The method according to claim 6, wherein the predicting a frequency domain signal that is not obtained by decoding comprises: estimating a resonant peak location of the frequency domain signal according to a line spectral frequency LSF or an immittance spectral frequency ISF, and when an amplitude of a predicted frequency domain coefficient near the resonant peak location is greater than a threshold, reducing the amplitude of the predicted frequency domain coefficient near the resonant peak location.

12. The method according to claim 6, wherein when the frequency domain signal obtained by decoding does not meet the predetermined condition, the frequency domain signal that is not obtained by decoding is predicted by using noise.

13. A signal coding device, wherein the device comprises:

a frequency domain transformation unit, which obtains a frequency domain signal according to an input signal;

a bit allocation unit, which allocates predetermined bits to the frequency domain signal according to a predetermined allocation rule; and

a bit adjustment unit, which adjusts the bit allocation for the frequency domain signal when a highest frequency of the frequency domain signal to which bits are allocated is greater than or equal to a predetermined value; and

a frequency domain coding unit, which codes the frequency domain signal according to the bit allocation for the frequency domain signal.

14. The device according to claim 13, wherein the bit adjustment unit adjusts the bit allocation for the frequency domain signal by reducing the number of bits allocated to a frequency band to which more bits are allocated in the frequency domain signal, and increasing the number of bits allocated to the highest frequency to which bits are allocated and its nearby frequency domain signal.

15. The device according to claim 13, wherein the predetermined value is determined according to the number of the predetermined bits and a resolution of the frequency domain signal.

16. The device according to claim 13, wherein the predetermined allocation rule is that: more bits in the predetermined bits are allocated to a low frequency band signal in the frequency domain signal, and rest bits in the predetermined bits are allocated to a frequency band with greater energy except the low frequency band signal.

17. The device according to claim 13, wherein when the highest frequency is less than the predetermined value, the bit adjustment unit does not adjust the bit allocation for the frequency domain signal, and the frequency domain coding unit codes the frequency domain signal according to the bit allocation that is performed by the bit allocation unit.

18. A signal decoding device, wherein the device comprises:

a decoding unit, which obtains, from a received bit stream, a frequency domain signal obtained by decoding;

a bandwidth extension unit, configured to predict a frequency domain signal that is not obtained by decoding, and when the frequency domain signal obtained by decoding meets a predetermined condition, predict, according to the frequency domain signal obtained by decoding, the frequency domain signal that is not obtained by decoding; and

an output unit, which obtains, according to the frequency domain signal obtained by decoding and the predicted frequency domain signal, a time domain signal that is finally outputted.

19. The device according to claim 18, wherein that the frequency domain signal obtained by

decoding meets a predetermined condition comprises at least one of the following: a highest frequency of the frequency domain signal obtained by decoding is greater than a predetermined value, and the frequency domain signal obtained by decoding comprises a time domain coding signal on which frequency domain transformation is performed and that contributes to an output signal.

20. The device according to claim 18 or 19, wherein the decoding unit obtains, from the received bit stream by performing the following operations, the frequency domain signal obtained by decoding:

performing frequency domain decoding on frequency domain information in the bit stream to obtain a first frequency domain signal;

determining, according to the first frequency domain signal, whether a time domain coding signal that contributes to the output signal exists in the bit stream; and

when it is determined that a time domain coding signal that contributes to the output signal exists in the bit stream, performing time domain decoding and frequency domain transformation on the time domain coding signal to obtain a second frequency domain signal, and synthesizing the first frequency domain signal and the second frequency domain signal to obtain the frequency domain signal obtained by decoding.

21. The device according to claim 19, wherein the predetermined value is determined according to the number of predetermined bits used for frequency domain coding and a resolution of the frequency domain signal obtained by decoding.

22. The device according to claim 18, wherein when the frequency domain signal obtained by decoding meets the predetermined condition, the bandwidth extension unit selects a frequency domain signal in a frequency band from the frequency domain signal obtained by decoding, and predicts, according to the selected frequency domain signal, the frequency domain signal that is not obtained by decoding.

23. The method according to claim 18, wherein after predicting, according to the frequency domain signal obtained by decoding, the frequency domain signal that is not obtained by decoding, the bandwidth extension unit estimates a resonant peak location of the frequency domain signal according to a line spectral frequency LSF or an immittance spectral frequency ISF, and when an amplitude of a predicted frequency domain coefficient near the resonant peak location is greater than a threshold, reduces the amplitude of the predicted frequency domain coefficient near the resonant peak location.

24. The device according to claim 18, wherein when the frequency domain signal obtained by decoding does not meet the predetermined condition, the bandwidth extension unit predicts, by

using noise, the frequency domain signal that is not obtained by decoding.

25. A computer-readable storage medium, wherein a computer instruction is stored in the storage medium, and driven by a processor, the instruction can perform the steps in any method according to claims 1 to 12.

CLAIMS

1. A signal coding method, wherein the method comprises:

obtaining a frequency domain signal according to an input signal;

allocating predetermined bits to the frequency domain signal according to a predetermined allocation rule;

adjusting the bit allocation for the frequency domain signal when a highest frequency of the frequency domain signal to which bits are allocated is greater than a predetermined value; and

coding the frequency domain signal according to the bit allocation for the frequency domain signal.

2. The method according to claim 1, wherein the adjusting the bit allocation for the frequency domain signal comprises: reducing the number of bits allocated to a frequency band to which more bits are allocated in the frequency domain signal, and increasing the number of bits allocated to the highest frequency to which bits are allocated and a frequency domain signal near the highest frequency.

3. The method according to claim 1 or 2, wherein the predetermined value is determined according to the number of the predetermined bits and a resolution of the frequency domain signal.

4. The method according to any one of claims 1 to 3, wherein the predetermined allocation rule is that: more bits in the predetermined bits are allocated to a low frequency band signal in the frequency domain signal, and rest bits in the predetermined bits are allocated to a frequency band with greater energy except the low frequency band signal.

5. The method according to any one of claims 1 to 4, further comprising:

if the highest frequency is less than the predetermined value, maintaining the bit allocation for the frequency domain signal that is performed according to the predetermined allocation rule.

6. A signal decoding method, wherein the method comprises:

obtaining, from a received bit stream, a frequency domain signal obtained by decoding;

when the frequency domain signal obtained by decoding meets a predetermined condition, predicting, according to the frequency domain signal obtained by decoding, a frequency domain signal that is not obtained by decoding; and

obtaining, according to the frequency domain signal obtained by decoding and the predicted frequency domain signal, a time domain signal that is finally outputted.

7. The method according to claim 6, wherein that the frequency domain signal obtained by decoding meets at least one of the following conditions:

a highest frequency of the frequency domain signal obtained by decoding is greater than a predetermined value; and

the frequency domain signal obtained by decoding comprises a time domain coding signal on which frequency domain transformation is performed and that contributes to an output signal.

8. The method according to claim 6 or 7, wherein the step of obtaining, from a received bit stream, a frequency domain signal obtained by decoding comprises:

performing frequency domain decoding on frequency domain information in the bit stream to obtain a first frequency domain signal;

determining, according to the first frequency domain signal, whether a time domain coding signal that contributes to the output signal exists in the bit stream; and

when it is determined that a time domain coding signal that contributes to the output signal exists in the bit stream, performing time domain decoding and frequency domain transformation on the time domain coding signal to obtain a second frequency domain signal, and synthesizing the first frequency domain signal and the second frequency domain signal to obtain the frequency domain signal obtained by decoding.

9. The method according to any one of claims 6 to 8, wherein the predetermined value is determined according to the number of predetermined bits used for frequency domain coding and a resolution of the frequency domain signal obtained by decoding.

10. The method according to any one of claims 6 to 9, wherein the predicting, according to the frequency domain signal obtained by decoding, a frequency domain signal that is not obtained by decoding comprises: selecting a frequency domain signal in a frequency band from the frequency domain signal obtained by decoding, and predicting, according to the selected frequency domain signal, the frequency domain signal that is not obtained by decoding.

11. The method according to any one of claims 6 to 10, wherein the predicting a frequency domain signal that is not obtained by decoding comprises: estimating a resonant peak location of the frequency domain signal according to a line spectral frequency (LSF) or an immittance spectral frequency (ISF), and when an amplitude of a predicted frequency domain coefficient near the resonant peak location is greater than a threshold, reducing the amplitude of the predicted frequency domain coefficient near the resonant peak location.

12. The method according to any one of claims 6 to 11, wherein when the frequency

domain signal obtained by decoding does not meet the predetermined condition, the frequency domain signal that is not obtained by decoding is predicted by using noise.

13. A signal coding device, wherein the device comprises:

a frequency domain transformation unit, configured to obtain a frequency domain signal according to an input signal;

a bit allocation unit, configured to allocate predetermined bits to the frequency domain signal according to a predetermined allocation rule; and

a bit adjustment unit, configured to adjust the bit allocation for the frequency domain signal when a highest frequency of the frequency domain signal to which bits are allocated is greater than or equal to a predetermined value; and

a frequency domain coding unit, configured to code the frequency domain signal according to the bit allocation for the frequency domain signal.

14. The device according to claim 13, wherein the bit adjustment unit configured to adjust the bit allocation for the frequency domain signal by reducing the number of bits allocated to a frequency band to which more bits are allocated in the frequency domain signal, and increasing the number of bits allocated to the highest frequency to which bits are allocated and a frequency domain signal near the highest frequency.

15. The device according to claim 13 or 14, wherein the predetermined value is determined according to the number of the predetermined bits and a resolution of the frequency domain signal.

16. The device according to any one of claims 13 to 15, wherein the predetermined allocation rule is that: more bits in the predetermined bits are allocated to a low frequency band signal in the frequency domain signal, and rest bits in the predetermined bits are allocated to a frequency band with greater energy except the low frequency band signal.

17. The device according to any one of claims 13 to 16, wherein when the highest frequency is less than the predetermined value, the bit adjustment unit configured to not adjust the bit allocation for the frequency domain signal, and the frequency domain coding unit codes the frequency domain signal according to the bit allocation that is performed by the bit allocation unit.

18. A signal decoding device, wherein the device comprises:

a decoding unit, configured to obtain, from a received bit stream, a frequency domain signal obtained by decoding;

a bandwidth extension unit, configured to predict, according to the frequency domain signal obtained by decoding, the frequency domain signal that is not obtained by decoding

when the frequency domain signal obtained by decoding meets a predetermined condition; and

an output unit, configured to obtain, according to the frequency domain signal obtained by decoding and the predicted frequency domain signal, a time domain signal that is finally outputted.

19. The device according to claim 18, wherein that the frequency domain signal obtained by decoding meets at least one of the following: a highest frequency of the frequency domain signal obtained by decoding is greater than a predetermined value, and the frequency domain signal obtained by decoding comprises a time domain coding signal on which frequency domain transformation is performed and that contributes to an output signal.

20. The device according to claim 18 or 19, wherein the decoding unit obtains, from the received bit stream by performing the following operations, the frequency domain signal obtained by decoding:

performing frequency domain decoding on frequency domain information in the bit stream to obtain a first frequency domain signal;

determining, according to the first frequency domain signal, whether a time domain coding signal that contributes to the output signal exists in the bit stream; and

when it is determined that a time domain coding signal that contributes to the output signal exists in the bit stream, performing time domain decoding and frequency domain transformation on the time domain coding signal to obtain a second frequency domain signal, and synthesizing the first frequency domain signal and the second frequency domain signal to obtain the frequency domain signal obtained by decoding.

21. The device according to any one of claims 18 to 20, wherein the predetermined value is determined according to the number of predetermined bits used for frequency domain coding and a resolution of the frequency domain signal obtained by decoding.

22. The device according to any one of claims 18 to 21, wherein when the frequency domain signal obtained by decoding meets the predetermined condition, the bandwidth extension unit selects a frequency domain signal in a frequency band from the frequency domain signal obtained by decoding, and predicts, according to the selected frequency domain signal, the frequency domain signal that is not obtained by decoding.

23. The device according to any one of claims 18 to 22, wherein after predicting, according to the frequency domain signal obtained by decoding, the frequency domain signal that is not obtained by decoding, the bandwidth extension unit estimates a resonant peak location of the frequency domain signal according to a line spectral frequency (LSF) or an

immittance spectral frequency (ISF), and when an amplitude of a predicted frequency domain coefficient near the resonant peak location is greater than a threshold, reduces the amplitude of the predicted frequency domain coefficient near the resonant peak location.

24. The device according to any one of claims 18 to 23, wherein when the frequency domain signal obtained by decoding does not meet the predetermined condition, the bandwidth extension unit predicts, by using noise, the frequency domain signal that is not obtained by decoding.

25. A computer-readable storage medium having a program recorded thereon; where the program makes the computer execute method of any of claims 1 to 12.