Claims

1. An apparatus for generating an audio output signal based on an encoded audio signal spectrum, wherein the apparatus comprises:

a processing unit ~~(110)~~ for processing the encoded audio signal spectrum to obtain a decoded audio signal spectrum the decoded audio signal spectrum comprising a plurality of spectral coefficients, wherein each of the spectral coefficients has a spectral location within the encoded audio signal spectrum and a spectral value, wherein the spectral coefficients are sequentially ordered according to their spectral location within the encoded audio signal spectrum so that the spectral coefficients form a sequence of spectral coefficients,

a pseudo coefficients determiner ~~(120)~~ for determining one or more pseudo coefficients of the decoded audio signal spectrum, each of the pseudo coefficients having a spectral location and a spectral value,

a spectrum modification unit ~~(130)~~ for setting the one or more pseudo coefficients to a predefined value to obtain a modified audio signal spectrum,

a spectrum-time conversion unit ~~(140)~~ for converting the modified audio signal spectrum to a time-domain to obtain a time-domain conversion signal,

a controllable oscillator ~~(150)~~ for generating a time-domain oscillator signal, the controllable oscillator ~~(150)~~ being controlled by the spectral location and the spectral value of at least one of the one or more pseudo coefficients, and

a mixer ~~(160)~~ for mixing the time-domain conversion signal and the time-domain oscillator signal to obtain the audio output signal.

2. An apparatus according to claim 1,

wherein each of the spectral coefficients has at least one of an immediate predecessor and an immediate successor, wherein the immediate predecessor of said spectral coefficient is one of the spectral coefficients that immediately precedes said spectral coefficient within the sequence of spectral coefficients, wherein the immediate successor of said spectral coefficient is one of the spectral coefficients that immediately succeeds said spectral coefficient within the sequence,

wherein the pseudo coefficients determiner ~~(120)~~ is configured to determine the one or more pseudo coefficients of the decoded audio signal spectrum by determining at least one spectral coefficient of the sequence which has a spectral value which is different from the predefined value, which has an immediate predecessor the spectral value of which is equal to the predefined value, and which has an immediate successor the spectral value of which is equal to the predefined value.

3. An apparatus according to claim 2, wherein the predefined value is zero.

4. An apparatus according to claim 2 or 3,

wherein the pseudo coefficients determiner ~~(120)~~ is configured to determine the one or more pseudo coefficients of the decoded audio signal spectrum by determining the at least one spectral coefficient of the sequence as a pseudo coefficient candidate, which has an immediate predecessor, the spectral value of which is equal to the predefined value, and which has an immediate successor, the spectral value of which is equal to the predefined value, and

wherein the pseudo coefficients determiner ~~(120)~~ is configured to determine whether the pseudo coefficient candidate is a pseudo coefficient by determining whether side information indicates that said pseudo coefficient candidate is a pseudo coefficient,.

5. An apparatus according to one of the preceding claims, wherein the controllable oscillator ~~(150)~~ is configured to generate the time-domain oscillator signal having a oscillator signal frequency so that the oscillator signal frequency of the oscillator signal depends on the spectral location of one of the one or more pseudo coefficients.

6. An apparatus according to claim 5,

wherein the pseudo coefficients are signed values, each comprising a sign component, and

wherein the controllable oscillator ~~(150)~~ is configured to generate the time-domain oscillator signal so that the oscillator signal frequency of the oscillator signal furthermore depends on the sign component of one of the one or more pseudo

coefficients so that the oscillator signal frequency has a first frequency value, when the sign component has a first sign value, and so that the oscillator signal frequency has a different second frequency value, when the sign component has a different second value.

7. An apparatus according to one of the preceding claims, wherein the controllable oscillator ~~(150)~~ is configured to generate the time-domain oscillator signal, wherein the amplitude of the oscillator signal depends on the spectral value of one of the one or more pseudo coefficients, so that the amplitude of the oscillator signal has a first amplitude value when the spectral value has a third value, and so that that the amplitude of the oscillator signal has a different second amplitude value when the spectral value has a different fourth value, the second amplitude value being greater than the first amplitude value, when the fourth value is greater than the third value.

8. An apparatus according to one of the preceding claims, wherein the controllable oscillator ~~(150)~~ is additionally controlled by one or more extrapolated parameters derived from a pseudo coefficient of a preceding frame.

9. An apparatus according to one of the preceding claims,

wherein the modified audio signal spectrum is an MDCT spectrum, comprising MDCT coefficients, and

wherein the spectrum-time conversion unit ~~(140)~~ is configured to convert the MDCT spectrum from an MDCT domain to the time domain by converting at least some of the coefficients of the decoded audio signal spectrum to the time domain.

10. An apparatus according to one of the preceding claims, wherein the mixer ~~(160)~~ is configured to mix the time-domain conversion signal and the time-domain oscillator signal by adding the time-domain conversion signal to the time-domain oscillator signal in the time-domain.

11. An apparatus according to one of the preceding claims,

wherein the time-domain oscillator signal generated by the controllable oscillator ~~(150)~~ is a first time-domain oscillator signal,

wherein the apparatus furthermore comprises one or more further controllable oscillators ~~(252, 254, 256)~~ for generating one or more further time-domain oscillator signals, wherein each of the one or more further controllable oscillators ~~(252, 254, 256)~~ is configured to generate one of the one or more further time-domain oscillator signals, wherein each of the further controllable oscillators ~~(252, 254, 256)~~ is controlled by the spectral location and the spectral value of at least one of the one or more pseudo coefficients, and

wherein the mixer ~~(160)~~ is configured to mix the first time-domain oscillator signal, the one or more further time-domain oscillator signals, and the time-domain conversion signal to obtain the audio output signal.

12. An apparatus for encoding an audio signal input spectrum of an audio signal, the audio signal input spectrum comprising a plurality of spectral coefficients, wherein each of the spectral coefficients has a spectral location within the audio signal input spectrum, a spectral value, wherein the spectral coefficients are sequentially ordered according to their spectral location within the audio signal input spectrum so that the spectral coefficients form a sequence of spectral coefficients, wherein each of the spectral coefficients has at least one of one or more predecessors and one or more successors, wherein the each of the predecessors of said spectral coefficient is one of the spectral coefficients that precedes said spectral coefficient within the sequence, wherein each of the successors of said spectral coefficient is one of the spectral coefficients that succeeds said spectral coefficient within the sequence, and wherein the apparatus comprises:

an extrema determiner ~~(410)~~ for determining one or more extremum coefficients,

a spectrum modifier ~~(420)~~ for modifying the audio signal input spectrum to obtain a modified audio signal spectrum by setting the spectral value of at least one of the predecessors or at least one of the successors of at least one of the extremum coefficients to a predefined value, wherein the spectrum modifier ~~(420)~~ is configured to not set the spectral values of the one or more extremum coefficients to the predefined value, or is configured to replace at least one of the one or more extremum coefficients by a pseudo coefficient, wherein the spectral value of the pseudo coefficient is different from the predefined value,

a processing unit ~~(430)~~ for processing the modified audio signal spectrum to obtain an encoded audio signal spectrum, and

a side information generator ~~(440)~~ for generating and transmitting side information, wherein the side information generator ~~(440)~~ is configured to locate one or more pseudo coefficient candidates within the modified audio signal input spectrum generated by the spectrum modifier ~~(420)~~, wherein the side information generator ~~(440)~~ is configured to select at least one of the pseudo coefficient candidates as selected candidates, and wherein the side information generator ~~(440)~~ is configured to generate the side information so that the side information indicates the selected candidates as the pseudo coefficients,

wherein the extrema determiner ~~(410)~~ is configured to determine the one or more extremum coefficients, so that each of the extremum coefficients is one of the spectral coefficients the spectral value of which is greater than the spectral value of at least one of its predecessors and the spectral value of which is greater than the spectral value of at least one of its successors, or

wherein each of the spectral coefficients has a comparison value associated with said spectral coefficient, wherein the extrema determiner ~~(410)~~ is configured to determine the one or more extremum coefficients, so that each of the extremum coefficients is one of the spectral coefficients the comparison value of which is greater than the comparison value of at least one of its predecessors and the comparison value of which is greater than the comparison value of at least one of its successors.

13. An apparatus according to claim 12, wherein the side information generator ~~(440)~~ is configured to transmit the size of the side information.

14. An apparatus according to claim 12 or 13, wherein the spectrum modifier ~~(420)~~ is configured to modify the audio signal input spectrum so that the spectral values of at least some of the spectral coefficients of the audio signal input spectrum are left unmodified in the modified audio signal spectrum.

15. An apparatus according to one of claims 12 to 14,

wherein each of the spectral coefficients has at least one of an immediate predecessor as one of its predecessors and an immediate successor as one of its successors, wherein the immediate predecessor of said spectral coefficient is one of the spectral coefficients that immediately precedes said spectral coefficient within

the sequence, wherein the immediate successor of said spectral coefficient is one of the spectral coefficients that immediately succeeds said spectral coefficient within the sequence,

wherein the spectrum modifier ~~(420)~~ is configured to modify the audio signal input spectrum to obtain the modified audio signal spectrum by setting the spectral value of the immediate predecessor or the immediate successor of at least one of the extremum coefficients to the predefined value, wherein the spectrum modifier ~~(420)~~ is configured to not set the spectral values of the one or more extremum coefficients to the predefined value, or is configured to replace at least one of the one or more extremum coefficients by a pseudo coefficient, wherein the spectral value of the pseudo coefficient is different from the predefined value, and

wherein the extrema determiner ~~(410)~~ is configured to determine the one or more extremum coefficients, so that each of the extremum coefficients is one of the spectral coefficients the spectral value of which is greater than the spectral value of its immediate predecessor and the spectral value of which is greater than the spectral value of its immediate successor, or wherein each of the spectral coefficients has a comparison value associated with said spectral coefficient, wherein the extrema determiner ~~(410)~~ is configured to determine the one or more extremum coefficients, so that each of the extremum coefficients is one of the spectral coefficients the comparison value of which is greater than the comparison value of its immediate predecessor and the comparison value of which is greater than the comparison value of its immediate successor.

16. An apparatus according to claim 15,

wherein the extrema determiner ~~(410)~~ is configured to determine one or more minimum coefficients, so that each of the one or more minimum coefficients is one of the spectral coefficients the spectral value of which is smaller than the spectral value of one of its predecessors and the spectral value of which is smaller than the spectral value of one of its successors, or wherein each of the spectral coefficients has a comparison value associated with said spectral coefficient, wherein the extrema determiner ~~(410)~~ is configured to determine the one or more minimum coefficients, so that each of the minimum coefficients is one of the spectral coefficients the comparison value of which is smaller than the comparison value of one of its predecessors and the comparison value of which is smaller than the comparison value of one of its successors, and

wherein the spectrum modifier ~~(420)~~ is configured to determine a representation value based on the spectral values or the comparison values of one or more of the extremum coefficients and one or more of the minimum coefficients, so that the representation value is different from the predefined value, and wherein the spectrum modifier ~~(420)~~ is configured to change the spectral value of one of the coefficients of the audio signal input spectrum by setting said spectral value to the representation value.

17. An apparatus according to claim 16,

wherein spectrum modifier ~~(420)~~ is configured to determine, whether a value difference between one of the comparison value or the spectral value of one of the extremum coefficients is smaller than a threshold value, and

wherein the spectrum modifier ~~(420)~~ is configured to modify the audio signal input spectrum so that the spectral values of at least some of the spectral coefficients of the audio signal input spectrum are left unmodified in the modified audio signal spectrum depending on whether the value difference is smaller than the threshold value.

18. An apparatus according to claim 16 or 17,

wherein the extrema determiner ~~(410)~~ is configured to determine one or more sub-sequences of the sequence of spectral values, so that each one of the sub-sequences comprises a plurality of subsequent spectral coefficients the audio signal input spectrum, the subsequent spectral coefficients being sequentially ordered within the sub-sequence according to their spectral position, wherein each of the sub-sequences has a first element being first in said sequentially-ordered sub-sequence and a last element being last in said sequentially-ordered sub-sequence, wherein each of the sub-sequences comprises exactly two of the minimum coefficients and exactly one of the extremum coefficients, one of the minimum coefficients being the first element of the sub-sequence, the other one of the minimum coefficients being the last element of the sub-sequence, and

wherein the spectrum modifier ~~(420)~~ is configured to determine the representation value based on the spectral values or the comparison values of the coefficients of one of the sub-sequences, and wherein the spectrum modifier ~~(420)~~ is configured to

change the spectral value of one of the coefficients of said sub-sequence by setting said spectral value to the representation value.

19. An apparatus according to claim 18, wherein the spectrum modifier ~~(420)~~ is configured to determine the representation value by determining a sum of the squares of the comparison values of the coefficients of said one of the sub-sequences.

20. An apparatus according to claim 18 or 19,

wherein the extrema determiner ~~(410)~~ is configured to determine a center-of-gravity coefficient by determining the product of the comparison value and the location value for each spectral coefficient of the sub-sequence to obtain a plurality of weighted coefficients, by summing up the weighted coefficients to obtain a first sum, summing up the comparison values of all spectral coefficients of the sub-sequence to obtain a second sum; by dividing the first sum by the second sum to obtain an intermediate result; and by applying round-to-nearest rounding on the intermediate result to obtain the center-of-gravity coefficient, and wherein the spectrum modifier ~~(420)~~ is configured to set the spectral values of all spectral coefficients of the sub-sequence, which are not the center-of-gravity coefficient to the predefined value, or

wherein the extrema determiner ~~(410)~~ is configured to determine a center-of-gravity coefficient by determining the product of the spectral value and the location value for each spectral coefficient of the sub-sequence to obtain a plurality of weighted coefficients, by summing up the weighted coefficients to obtain a first sum, summing up the spectral values of all spectral coefficients of the sub-sequence to obtain a second sum; by dividing the first sum by the second sum to obtain an intermediate result; and by applying round-to-nearest rounding on the intermediate result to obtain the center-of-gravity coefficient, and wherein the spectrum modifier ~~(420)~~ is configured to set the spectral values of all spectral coefficients of the sub-sequence, which are not the center-of-gravity coefficient to the predefined value.

21. An apparatus according to one of claims 12 to 20, wherein the predefined value is zero.

22. An apparatus according to one of claims 12 to 21, wherein the comparison value of each spectral coefficient is a square value of a further coefficient of a further spectrum resulting from an energy preserving transformation of the audio signal.

23. An apparatus according to one of claims 12 to 22, wherein the comparison value of each spectral coefficient is an amplitude value of a further coefficient of a further spectrum resulting from an energy preserving transformation of the audio signal.

24. An apparatus according to one of claims 12 to 23, wherein the further spectrum is a Complex Modified Discrete Cosine Transform spectrum, and wherein the energy preserving transformation is a Complex Modified Discrete Cosine Transform.

25. An apparatus according to one of claims 12 to 24,

wherein the spectrum modifier ~~(420)~~ is configured to receive fine-tuning information,

wherein the spectral coefficients of the audio signal input spectrum are signed values, each comprising a sign component,

wherein the spectrum modifier ~~(420)~~ is configured to set the sign component of the spectral value of one of the one or more extremum coefficients or of the pseudo coefficient to a first sign value, when the fine-tuning information is in a first fine-tuning state to obtain the modified audio signal spectrum, and

wherein the spectrum modifier ~~(420)~~ is configured to set the sign component of the spectral value of one of the one or more extremum coefficients or of the pseudo coefficient to a different second sign value, when the fine-tuning information is in a different second fine-tuning state to obtain the modified audio signal spectrum.

26. An apparatus according to one of claims 12 to 25, wherein the audio signal input spectrum is an MDCT spectrum comprising MDCT coefficients.

27. An apparatus according to one of claims 12 to 26,

wherein the processing unit ~~(430)~~ is configured to quantize the modified audio signal spectrum to obtain a quantized audio signal spectrum,

wherein the processing unit ~~(430)~~ is furthermore configured to process the quantized audio signal spectrum to obtain an encoded audio signal spectrum,

wherein the processing unit ~~(430)~~ is furthermore configured to generate side information indicating only for those spectral coefficients of the quantized audio signal spectrum which have an immediate predecessor the spectral value of which is equal to the predefined value and an immediate successor, the spectral value of which is equal to the predefined value, whether said coefficient is one of the extremum coefficients,

wherein the immediate predecessor of said spectral coefficient is another spectral coefficient which immediately precedes said spectral coefficient within the quantized audio signal spectrum, and wherein the immediate successor of said spectral coefficient is another spectral coefficient which immediately succeeds said spectral coefficient within the quantized audio signal spectrum.

28. An apparatus according to one of claims 12 to 27, wherein the spectrum modifier ~~(420)~~ is configured to replace one of the extremum coefficients by a pseudo coefficient having a spectral value derived from the spectral value or the comparison value of said extremum coefficient, from the spectral value or the comparison value of said extremum coefficient of one of the predecessors of said extremum coefficient or from the spectral value or the comparison value of said extremum coefficient of one of the successors of said extremum coefficient.

29. A method for generating an audio output signal based on an encoded audio signal spectrum, wherein each of the spectral coefficients has a spectral location within the encoded audio signal spectrum and a spectral value, wherein the spectral coefficients are sequentially ordered according to their spectral location within the encoded audio signal spectrum so that the spectral coefficients form a sequence of spectral coefficients, and wherein the method comprises:

processing the encoded audio signal spectrum to obtain a decoded audio signal spectrum the decoded audio signal spectrum comprising a plurality of spectral coefficients,

determining one or more pseudo coefficients of the decoded audio signal spectrum, each of the pseudo coefficients having a spectral location and a spectral value,