Claims

1. Apparatus for encoding an audio signal, comprising:

a core encoder for core encoding first audio data in a first spectral band;

a parametric coder for parametrically coding second audio data in a second spectral band being different from the first spectral band, wherein the parametric coder comprises:

an analyzer for analyzing the first audio data in the first spectral band to obtain a first analysis result and for analyzing the second audio data in the second spectral band to obtain a second analysis result;

a compensator for calculating a compensation value using the first analysis result and the second analysis result; and

a parameter calculator for calculating a parameter from the second audio data in the second spectral band using the compensation value,

wherein the parametric coder is configured for parametrically coding third audio data in a third spectral band;

wherein the analyzer is configured for analyzing the third audio data in the third spectral band to obtain a third analysis result;

wherein the parametric coder further comprises a compensation detector for detecting, using at least the third analysis result, whether the third spectral band is to be compensated or not, and

wherein the parameter calculator is configured to calculate a further parameter from the third audio data in the third spectral band without any compensation value, when the compensation detector detects that the third spectral band is not to be compensated.

2. Apparatus of claim 1,

wherein the analyzer is configured to calculate, as the first analysis result, a first quantitative value, and as the second analysis result, a second quantitative value,

wherein the compensator is configured to calculate a quantitative compensation value from the first quantitative value and from the second quantitative value, and

wherein the parameter calculator is configured for calculating a quantitative parameter using the quantitative compensation value.

3. Apparatus of any one of claims 1 to 2,

wherein the analyzer is configured to analyze a first characteristic of the first audio data to obtain the first analysis result, and to analyze the same first characteristic of the second audio data in the second spectral band to obtain the second analysis result, and

wherein the parameter calculator is configured for calculating the parameter from the second audio data in the second spectral band by evaluating a second characteristic, the second characteristic being different from the first characteristic.

4. Apparatus of claim 3,

wherein the first characteristic is a spectral fine structure characteristic or an energy distribution characteristic within the first spectral band, or

wherein the second characteristic is an envelope measure or an energy related measure or a power related measure of spectral values within the second spectral band.

5. Apparatus of any one of claims 1 to 4,

wherein the first spectral band and the second spectral band are mutually exclusive to each other,

wherein the analyzer is configured to calculate the first analysis result without using the second audio data in the second spectral band, and to calculate the second analysis result without using the first audio data in the first spectral band.

6. Apparatus of any one of claims 1 to 5,

wherein the audio signal comprises a time sequence of frames,

wherein the compensator is configured to calculate a current compensation value for a current frame using a previous compensation value for a previous frame.

7. Apparatus of any one of claims 1 to 6,

wherein the parametric coder is configured for parametrically coding third audio data in a third spectral band,

wherein the third spectral band comprises higher frequencies than the second spectral band, and

wherein the compensator is configured to use a third weighting value in calculating a compensation value for the third spectral band,

wherein the third weighting value is different from a second weighting value used for calculating a compensation value for the second spectral band.

8. Apparatus of any one of claims 1 to 8, wherein the analyzer is configured to additionally calculate a tonal-to-noise ratio of the second audio data in the second spectral band, and

wherein the compensator is configured to calculate the compensation value dependent on the tonal-to-noise ratio of the second audio data so that a first compensation value is obtained for a first tonal-to-noise ratio or a second compensation value is obtained for a second tonal-to-noise ratio, the first compensation value being greater than the second compensation value, and the first tonal-to-noise ratio being greater than the second tonal-to-noise ratio.

9. Apparatus of any one of claims 1 to 8, wherein the parameter calculator is configured for calculating a non-compensated parameter from the second audio data and for combining the non-compensated parameter and the compensation value to obtain the parameter.

10. Apparatus of any one of claims 1 to 9,

further comprising an output interface for outputting core-encoded audio data in the first spectral band and the parameter.

11. Apparatus of any one of claims 1 to 10,

wherein the compensator is configured to determine the compensation value by applying a psychoacoustic model, wherein the psychoacoustic model is configured to evaluate a psychoacoustic mismatch between the first audio data and the second audio data using the first analysis result and the second analysis result to obtain the compensation value.

12. Apparatus of any one of claims 1 to 11,

wherein the audio signal comprises a time-sequence of frames, and

wherein the analyzer is configured for analyzing first audio data in the first spectral band of a frame to obtain the first analysis result and for analyzing second audio data of the frame in the second spectral band to obtain a second analysis result for the frame, wherein the compensator is configured for calculating a compensation value for the frame using the first analysis result for the frame and the second analysis result for the frame; and wherein the parameter calculator is configured for calculating the parameter from the second audio data in the second spectral band of the frame using the compensation value for the frame, or

wherein the parametric coder further comprises: a compensation detector for detecting, based on the first analysis result and the second analysis result, whether the parameter for the second spectral band of a frame is to be calculated either using

the compensation value in a compensation situation or in a non-compensation situation.

13. Apparatus of claim 1,

wherein a compensation detector is configured to detect a compensation situation, when a difference between the first analysis result and the second analysis result has a predetermined characteristic, or when the second analysis result has a predetermined characteristic,

wherein the compensation detector is configured to detect that a spectral band is not to be compensated, when a power spectrum is not available to the audio encoder or when a current frame is detected to be a transient frame, or

wherein the compensator is configured to calculate the compensation value based on a quotient of the first analysis result and the second analysis result.

14. Apparatus of any one of claims 1 to 13,

wherein the analyzer is configured to calculate a spectral flatness measure, a crest factor or a quotient of the spectral flatness measure and the crest factor for the first spectral band as the first analysis result, and to calculate a spectral flatness measure or a crest factor or a quotient of the spectral flatness measure and the crest factor for the second spectral band as the second analysis result, or

wherein the parameter calculator is configured to calculate, from the second audio data, a spectral envelope information or a gain factor, or

wherein the compensator is configured to calculate the compensation value so that, for a first difference between the first analysis result and the second analysis result, a first compensation value is obtained, and for a second difference between the first analysis result and the second analysis result, a second compensation value is calculated, wherein the first difference is greater than the second difference, and wherein the first compensation value is greater than the second compensation value.

15. Apparatus of claim 14,

wherein the analyzer is configured to calculate a spectral tilt from the second audio data,

wherein the analyzer is configured to examine whether there is a tonal component close to a border of the second spectral band, and

wherein a compensation detector of the parametric coder is configured to determine that the parameter is to be calculated using the compensation value only when the spectral tilt is below a predetermined threshold, or when the spectral tilt is above a predetermined threshold and the examination has determined that there exists a tonal component close to the border.

16. Apparatus of any one of claims 1 to 15, further comprising:

a decoder for decoding encoded first audio data in the first spectral band to obtain encoded and decoded first audio data,

wherein the analyzer is configured to calculate the first analysis result using the encoded and decoded first audio data, and

to calculate the second analysis result from the second audio data from the audio signal input into the apparatus for encoding.

17. Apparatus of any one of claims 1 to 16, further comprising:

a patch simulator for simulating a patching result for the second spectral band, the patching result comprising at least one spectral line from the second spectral band included in a core encoded audio signal;

wherein the analyzer is configured to calculate the first analysis result using the first audio data and the at least one spectral line from the second spectral band; and

to calculate the second analysis result from the second audio data from the audio signal input into the apparatus for encoding.

18. Apparatus of any one of claims 1 to 17,

wherein the core encoder is configured to encode the first audio data in a sequence of real valued spectra,

wherein the analyzer is configured to calculate the first and the second analysis result from a sequence of power spectra,

wherein a power spectrum is calculated from the audio signal input into the apparatus for encoding or is derived from a real valued spectrum used by the core encoder.

19. Apparatus of any one of claims 1 to 18,

wherein the core encoder is configured to core encode the audio signal at least in a core band extending until an enhancement start frequency,

wherein the core band comprises the first spectral band and at least one further source band overlapping with the first spectral band,

wherein the audio signal comprises an enhancement range extending from the enhancement start frequency until a maximum frequency, wherein the second spectral band and at least one further target band are included in the enhancement range, wherein the second spectral band and the further target band do not overlap with each other.

20. Apparatus of claim 19,

wherein the enhancement start frequency is a cross-over frequency and a core encoded signal is band limited to the cross-over frequency, or

wherein the enhancement start frequency is an intelligent gap filling start frequency and a core encoded signal is band-limited to the maximum frequency being greater than the enhancement start frequency.

21. Apparatus of any one of claims 1 to 20,

wherein the parameter calculator is configured

to calculate a gain factor for the second spectral band based on the second audio data in the second spectral band,

to calculate a damping factor as the compensation value, and

to multiply the gain factor for the band by the damping factor to obtain a compensated gain factor as the parameter, and

wherein the apparatus further comprises an output interface for outputting core-encoded audio data in the first spectral band and the compensated gain factor as the parameter.

22. Method of encoding an audio signal, comprising:

core encoding first audio data in a first spectral band;

parametrically coding second audio data in a second spectral band being different from the first spectral band, wherein the parametrically coding comprises:

analyzing the first audio data in the first spectral band to obtain a first analysis result and analyzing the second audio data in the second spectral band to obtain a second analysis result;

calculating a compensation value using the first analysis result and the second analysis result; and

calculating a parameter from the second audio data in the second spectral band using the compensation value,

parametrically coding third audio data in a third spectral band;

analyzing the third audio data in the third spectral band to obtain a third analysis result;

detecting, using at least the third analysis result, whether the third spectral band is to be compensated or not; and

calculating a further parameter from the third audio data in the third spectral band without any compensation value, when the step of detecting detects that the third spectral band is not to be compensated.

23. System for processing an audio signal, comprising:

an apparatus for encoding an audio signal of any one of claims 1 to 21; and

a decoder for receiving an encoded audio signal comprising encoded first audio data in the first spectral band and a parameter representing second audio data in the second spectral band,

wherein the decoder is configured for performing a spectral enhancement operation in order to regenerate synthesized audio data for the second spectral band using the parameter and decoded first audio data in the first spectral band.

24. Method of processing an audio signal, comprising:

encoding an audio signal in accordance with claim 22; and

receiving an encoded audio signal comprising encoded first audio data in the first spectral band and a parameter representing second audio data in the second spectral band; and

performing a spectral enhancement operation in order to regenerate synthesized audio data for the second spectral band using the parameter and decoded first audio data in the first spectral band.

25. A computer-readable medium having computer-readable code stored thereon to perform the method according to any one of claims 22 or 24, when the computer-readable code is run by a computer.