Claims

1. Audio encoder for encoding a multichannel signal, comprising:

a linear prediction domain encoder;

a frequency domain encoder;

a controller for switching between the linear prediction domain encoder and the frequency domain encoder,

wherein the linear prediction domain encoder comprises a downmixer for downmixing the multichannel signal to obtain a downmix signal, a linear prediction domain core encoder for encoding the downmix signal and a first joint multichannel encoder for generating first multichannel information from the multichannel signal,

wherein the frequency domain encoder comprises a second joint multichannel encoder for encoding second multichannel information from the multichannel signal, wherein the second joint multichannel encoder is different from the first joint multichannel encoder, and

wherein the controller is configured such that a portion of the multichannel signal is represented either by an encoded frame of the linear prediction domain encoder or by an encoded frame of the frequency domain encoder.

2. Audio encoder of claim 1, wherein the first joint multichannel encoder comprises a first time-frequency converter, wherein the second joint multichannel encoder comprises a second time-frequency converter, and wherein the first and the second time-frequency converters are different from each other.

3. Audio encoder of claim 1 or 2, wherein the first joint multichannel encoder is a parametric joint multichannel encoder; or

wherein the second joint multichannel encoder is a waveform-preserving joint multichannel encoder.

4. Audio encoder according to claim 3,

wherein the parametric joint multichannel encoder comprises a stereo production coder, a parametric stereo encoder or a rotation-based parametric stereo encoder, or

wherein the waveform-preserving joint multichannel encoder comprises a band-selective switch mid/side or left/right stereo coder.

5. Audio encoder according to one of the preceding claims,

wherein the linear prediction domain encoder comprises an ACELP processor and a TCX processor, wherein the ACELP processor is configured to operate on a downsampled downmix signal and wherein a time domain bandwidth extension processor is configured to parametrically encode a band of a portion of the downmix signal removed from the ACELP input signal by a third downsampling, and

wherein the TCX processor is configured to operate on the downmix signal not downsampled or downsampled by a degree smaller than the downsampling for the ACELP processor, the TCX processor comprising a first time-frequency converter, a first parameter generator for generating a parametric representation of a first set of bands and a first quantizer encoder for generating a set of quantized encoder spectral lines for a second set of bands.

6. Audio encoder of one of the preceding claims, wherein the frequency domain encoder comprises a second time-frequency converter for converting a first channel of the multichannel signal and a second channel of the multichannel signal into a spectral representation, a second parameter generator for generating a parametric representation of a second set of bands and a second quantizer encoder for generating a quantized and encoded representation of a first set of bands.

7. Audio encoder of one of the preceding claims,

wherein the linear prediction domain encoder comprises an ACELP processor with a time-domain bandwidth extension and a TCX processor with an MDCT operation and an intelligent gap filling functionality, or

wherein the frequency domain encoder comprises an MDCT operation for the first channel and the second channel and an AAC operation and an intelligent gap filling functionality, or

wherein the first joint multichannel encoder is configured to operate in such a way that multichannel information for a full bandwidth of the multichannel audio signal is derived.

8. Audio encoder of one of the preceding claims, further comprising:

a linear prediction domain decoder for decoding the downmix signal to obtain an encoded and decoded downmix signal; and

a multichannel residual coder for calculating and encoding a multichannel residual signal using the encoded and decoded downmix signal representing an error between a decoded multichannel representation using the first multichannel information and the multichannel signal before downmixing.

9. Audio encoder of claim 8,

wherein the downmix signal has a low band and a high band, wherein the linear prediction domain encoder is configured to apply a bandwidth extension processing for parametrically encoding the high band, wherein the linear prediction domain decoder is configured to obtain, as the encoded and decoded downmix signal only a low band signal representing the low band of the downmix signal, and wherein the encoded multichannel residual signal only has frequency within the low band of the multichannel signal before downmixing.

10. Audio encoder of claim 8 or 9,

wherein the multichannel residual coder comprises:

a joint multichannel decoder for generating a decoded multichannel signal using the first multichannel information and the encoded and decoded downmixed signal; and

a difference processor for forming a difference between the decoded multichannel signal and the multichannel signal before downmixing to obtain the multichannel residual signal.

11. Audio encoder of one of the preceding claims,

wherein the downmixer is configured to convert the multichannel signal into a spectral representation and where the downmixing is performed using the spectral representation or using a time domain representation, and

wherein the first multichannel encoder is configured to use the spectral representation to generate separate first multichannel information for individual bands of the spectral representation.

12. Audio encoder of one of the preceding claims,

wherein the controller is configured to switch within a current frame of a multichannel audio signal from using the frequency domain encoder for encoding a previous frame to the linear prediction domain encoder for decoding an upcoming frame;

wherein the first joint multichannel encoder is configured to calculate synthetic multichannel parameters from the multichannel audio signal for the current frame;

wherein the second joint multichannel encoder is configured to weight the second multichannel signal using a stop window.

13. Audio decoder for decoding an encoded audio signal, comprising:

a linear prediction domain decoder;

a frequency domain decoder;

a first joint multichannel decoder for generating a first multichannel representation using an output of the linear prediction domain decoder and using a first multichannel information;

a second joint multichannel decoder for generating a second multichannel representation using an output of the frequency domain decoder and a second multichannel information; and

a first combiner for combining the first multichannel representation and the second multichannel representation to obtain a decoded audio signal

wherein the second joint multichannel decoder is different from the first joint multichannel decoder.

14. Audio decoder of claim 13,

wherein the first joint multichannel decoder is a parametric joint multichannel decoder and wherein the second joint multichannel decoder is a waveform-preserving joint multichannel decoder,

wherein the first joint multichannel decoder is configured to operate based on a complex prediction, a parametric stereo operation, or a rotation operation, and

wherein the second joint multichannel decoder is configured to apply a band-selective switch to mid/side or left/right stereo decoding algorithm.

15. Audio decoder of claim 13 or 14, wherein the linear prediction domain decoder comprises:

an ACELP decoder, a low band synthesizer, an upsampler, a time domain bandwidth extension processor or a second combiner for combining an upsampled signal and a bandwidth-extended signal;

a TCX decoder and an intelligent gap filling processor;

a full band synthesis processor for combining an output of the second combiner and a TCX decoder and the IGF processor or

wherein a cross-path is provided for initializing the low band synthesizer using information derived by a low band spectrum-time conversion from the TCX decoder and the IGF processor.

16. Audio decoder of one of claims 13 to 15,

wherein the first joint multichannel decoder comprises a time-frequency converter for converting the output of the linear prediction domain decoder into a spectral representation;

an upmixer controlled by the first multichannel information operating on the spectral representation; and

a frequency-time converter for converting an upmix result into a time representation period.

17. Audio decoder of one of claims 13 to 16,

wherein the second joint multichannel decoder is configured to use, as an input, a spectral representation obtained by the frequency domain decoder, the spectral representation comprising, at least for a plurality of bands, a first channel signal and a second channel signal and

to apply a joint multichannel operation to the plurality of bands of the first channel signal and the second channel signal and to convert a result of the joint multichannel decoder joint multichannel operation into a time representation to obtain the second multichannel representation.

18. Audio decoder of claim 17, wherein the second multichannel information is a mask indicating, for individual bands, a left/right or mid/side joint multichannel coding, and wherein the joint multichannel operation is a mid/side to left/right converting operation for converting bands indicated by the mask from the mid/side representation to a left/right representation.

19. Audio decoder of one of claims 13 to 18,

wherein the multichannel encoded audio signal comprises a residual signal for the output of the linear prediction domain decoder,

wherein the first joint multichannel decoder is configured to use the multichannel residual signal for generating the first multichannel representation.

20. Audio decoder of claim 19, wherein the multichannel residual signal has a lower bandwidth than the first multichannel representation, and wherein the first joint multichannel decoder is configured to reconstruct an intermediate first multichannel representation using the first joint multichannel information and to add the multichannel residual signal to the intermediate first multichannel representation.

21. Audio decoder of claim 16,

wherein the time-frequency converter comprises a complex operation or an oversampled operation, and

wherein the frequency domain decoder comprises an IMDCT operation or a critically-sampled operation.

22. Audio decoder of claims 13 to 21,

wherein the audio decoder is configured to switch within a current frame of a multichannel audio signal from using the frequency domain decoder for decoding a previous frame to the linear prediction domain decoder for decoding an upcoming frame;

wherein the combiner is configured to calculate a synthetic mid-signal from the second multichannel representation of the current frame;

wherein the first joint multichannel decoder is configured to generate the first multichannel representation using the synthetic mid-signal and a first multichannel information;

wherein the combiner is configured to combine the first multichannel representation and the second multichannel representation to obtain a decoded current frame of the multichannel audio signal.

23. Audio decoder of claims 13 to 22,

wherein the audio decoder is configured to switch within a current frame of a multichannel audio signal from using the linear prediction domain decoder for decoding a previous frame to the frequency domain decoder for decoding an upcoming frame;

wherein the stereo decoder 146 is configured to calculate a synthetic multichannel audio signal from a decoded mono signal of the linear prediction domain decoder for a current frame using multichannel information of a previous frame;

wherein the second joint multichannel decoder is configured to calculate the second multichannel representation for the current frame and to weight the second multichannel representation using a start window;

wherein the combiner is configured to combine the synthetic multichannel audio signal and the weighted second multichannel representation to obtain a decoded current frame of the multichannel audio signal.

24. Audio decoder or audio encoder of one of the preceding claims, wherein multichannel means two or more channels.

25. Method of encoding a multichannel signal comprising:

performing a linear prediction domain encoding;

performing a frequency domain encoding;

switching between the linear prediction domain encoding and the frequency domain encoding,

wherein the linear prediction domain encoding comprises downmixing the multichannel signal to obtain a downmix signal, a linear prediction domain core encoding the downmix signal and a first joint multichannel encoding generating first multichannel information from the multichannel signal,

wherein the frequency domain encoding comprises a second joint multichannel encoding generating second multichannel information from the multichannel signal, wherein the second joint multichannel encoding is different from the first multichannel encoding, and

wherein the switching is performed such that a portion of the multichannel signal is represented either by an encoded frame of the linear prediction domain encoding or by an encoded frame of the frequency domain encoding.

26. Method of decoding an encoded audio signal, comprising:

linear prediction domain decoding;

frequency domain decoding;

first joint multichannel decoding generating a first multichannel representation using an output of the linear prediction domain decoding and using a first multichannel information;

a second multichannel decoding generating a second multichannel representation using an output of the frequency domain decoding and a second multichannel information; and

combining the first multichannel representation and the second multichannel representation to obtain a decoded audio signal,

wherein the second multichannel decoding is different from the first multichannel decoding.

27. Computer program for performing, when running on a computer or a processor, the method of claim 25 or claim 26.