Claims

1. An apparatus for generating one or more audio output signals from one or more encoded audio signals, wherein the apparatus comprises:

at least one entropy decoding module for decoding encoded additional audio information, when the encoded additional audio information is entropy-encoded, to obtain decoded additional audio information, and

a signal processor for generating the one or more audio output signals depending on the one or more encoded audio signals and depending on the decoded additional audio information.

2. An apparatus according to claim 1,

wherein the apparatus further comprises:

at least one non-entropy decoding module for decoding the encoded additional audio information, when the encoded additional audio information is not entropy-encoded, to obtain the decoded additional audio information, and

a selector for selecting one of the at least one entropy decoding module and of the at least one non-entropy decoding module for decoding the encoded additional audio information depending on whether or not the encoded additional audio information is entropy-encoded.

3. An apparatus according to claim 1 or 2,

wherein the encoded additional audio information comprises augmented reality data or virtual reality data.

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

wherein the encoded additional audio information depends on a real listening environment or depends on a virtual listening environment or depends on an augmented listening environment.

5. An apparatus according to claim 4,

wherein the encoded additional audio information comprises propagation information depending on one or more propagations of one or more sound waves along one or more propagation paths in the real listening environment or in the virtual listening environment or in the augmented listening environment.

6. An apparatus according to claim 5,

wherein the propagation information is reflection information depending on one or more reflections at one or more reflection objects of one or more sound waves propagating along one or more propagation paths in the real listening environment or in the virtual listening environment or in the augmented listening environment.

7. An apparatus according to claim 5,

wherein the propagation information is diffraction information depending on one or more diffractions at one or more diffraction objects of one or more sound waves propagating along one or more propagation paths in the real listening environment or in the virtual listening environment or in the augmented listening environment.

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

wherein the encoded additional audio information comprises data for rendering early reflections,

wherein the signal processor is configured to generate the one or more audio output signals depending on the data for rendering early reflections.

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

wherein the signal processor is configured to generate a binaural signal comprising two binaural channels as the one or more audio output signals.

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

wherein the at least one entropy decoding module comprises a Huffman decoding module for decoding the encoded additional audio information, when the encoded additional audio information is Huffman-encoded.

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

wherein the at least one entropy decoding module comprises an arithmetic decoding module for decoding the encoded additional audio information, when the encoded additional audio information is arithmetically-encoded.

12. An apparatus according to claim 2 and claim 10 and claim 11,

wherein the selector is configured to select one of the at least one non-entropy decoding module and of the Huffman decoding module and of the arithmetic decoding module for decoding the encoded additional audio information.

13. An apparatus according to one of the preceding claims, further depending on claim 2,

wherein the at least one non-entropy decoding module comprises a fixed-length decoding module for decoding the encoded additional audio information, when the encoded additional audio information is fixed-length-encoded.

14. An apparatus according to one of the preceding claims further depending on claim 2,

wherein the apparatus is configured to receive selection information, and

wherein the selector is configured to select one of the at least one entropy decoding module and of the at least one non-entropy decoding module depending on the selection information.

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

wherein the apparatus is configured to receive a codebook or a coding tree on which the encoded additional audio information depends, and,

wherein the at least entropy decoding module is configured to decode the encoded additional audio information using the codebook or using the coding tree.

16. An apparatus according to claim 15,

wherein the apparatus is configured to receive an encoding of a structure of the coding tree on which the encoded additional audio information depends,

wherein the at least entropy decoding module is configured to reconstruct a plurality of codewords of the coding tree depending on the structure of the coding tree, and

wherein the at least entropy decoding module is configured to decode the encoded additional audio information using the codewords of the coding tree.

17. An apparatus according to one of claims 1 to 14,

wherein the apparatus further comprises a memory having stored thereon a codebook or a coding tree,

wherein the at least entropy decoding module is configured to decode the encoded additional audio information using the codebook or using the coding tree.

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

wherein the apparatus is configured to receive the encoded additional audio information comprising a plurality of transmitted symbols and an offset value, and

wherein the at least one non-entropy decoding module is configured to decode the encoded additional audio information using the plurality of transmitted symbols and using the offset value.

19. An apparatus according to one of the preceding claims, further depending on claim 8,

wherein the data for rendering early reflections comprises information on a location of one or more walls, being one or more real walls or virtual walls in an environment,

wherein the signal processor is configured to generate the one or more audio output signals depending on the information on the location of one or more walls.

20. An apparatus according to claim 19,

wherein the information on each wall of the one or more walls comprises information on a azimuth angle and/or an elevation angle of said wall, wherein the azimuth angle of said wall is entropy-encoded and/or the elevation angle of said wall is entropy-encoded, and

wherein one or more entropy decoding modules of the at least one entropy decoding module are configured to decode an entropy-encoded azimuth angle of said wall and/or an entropy-encoded elevation angle of said wall.

21. An apparatus according to claim 20, further depending on one of claims 15 to 17,

wherein said one or more of the at least one entropy decoding module are configured to decode the entropy-encoded azimuth angle of said wall and/or the entropy-encoded elevation angle of said wall using the codebook or the coding tree.

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

wherein the encoded additional audio information comprises voxel position information, wherein the position information comprises information on one or more positions of one or more voxels out of a plurality of voxels within a three-dimensional coordinate system,

wherein the signal processor is configured to generate the one or more audio output signals depending on the voxel position information.

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

wherein the at least one entropy decoding module is configured to decode encoded additional audio information being entropy-encoded, wherein the encoded additional audio information being entropy-encoded comprises at least one of the following:

- a list of triangle indexes,
- an array length of a list of triangle indexes,
- an array with azimuth angles specifying surface normals in spherical coordinates,

- an array with elevation angles specifying surface normals in spherical coordinates,

- an array with distance values,

- an array with positions of a listener,

- an array with positions of one or more sound sources,

- a removal list or a removal set, specifying indices of reflection sequences of a set of reflection sequences that shall be removed or a reference reflection sequence list that shall be removed,

- a number of reflection sequences or a number of reflection paths,

- an array specifying a reflection order,

- reflection sequences.

24. An apparatus for encoding one or more audio signals and additional audio information, wherein the apparatus comprises:

an audio signal encoder for encoding the one or more audio signals to obtain one or more encoded audio signals, and

at least one entropy encoding module for encoding the additional audio information using entropy encoding to obtain encoded additional audio information.

25. An apparatus according to claim 24,

wherein the apparatus further comprises:

at least one non-entropy encoding module for encoding the additional audio information to obtain the encoded additional audio information, and

a selector for selecting one of the at least one entropy encoding module and of the at least one non-entropy encoding module for encoding the additional audio

information depending on a symbol distribution within the additional audio information that is to be encoded.

26. An apparatus according to claim 24 or 25,

wherein the encoded additional audio information comprises augmented reality data or virtual reality data.

27. An apparatus according to one of claims 24 to 26,

wherein the encoded additional audio information depends on a real listening environment or depends on a virtual listening environment or depends on an augmented listening environment.

28. An apparatus according to claim 27,

wherein the encoded additional audio information comprises propagation information depending on one or more propagations of one or more sound waves along one or more propagation paths in the real listening environment or in the virtual listening environment or in the augmented listening environment.

29. An apparatus according to claim 28,

wherein the propagation information is reflection information depending on one or more reflections at one or more reflection objects of one or more sound waves propagating along one or more propagation paths in the real listening environment or in the virtual listening environment or in the augmented listening environment.

30. An apparatus according to claim 28,

wherein the propagation information is diffraction information depending on one or more diffractions at one or more diffraction objects of one or more sound waves propagating along one or more propagation paths in the real listening environment or in the virtual listening environment or in the augmented listening environment.

31. An apparatus according to one of claims 24 to 30,

wherein the encoded additional audio information comprises data for rendering early reflections.

32. An apparatus according to one of claims 24 to 31,

wherein the at least one entropy encoding module comprises a Huffman encoding module for encoding the additional audio information using Huffman encoding.

33. An apparatus according to one of claims 24 to 32,

wherein the at least one entropy encoding module comprises an arithmetic encoding module for encoding the additional audio information using arithmetic encoding.

34. An apparatus according to claim 25 and claim 32 and claim 33,

wherein the selector is configured to select one of the at least one non-entropy encoding module and of the Huffman encoding module and of the arithmetic encoding module for encoding the additional audio information.

35. An apparatus according to one of claims 24 to 34, further depending on claim 25,

wherein the at least one non-entropy encoding module comprises a fixed-length encoding module for encoding the additional audio information.

36. An apparatus according to one of claims 24 to 35, further depending on claim 25,

wherein the apparatus is configured to generate selection information indicating one of the at least one entropy encoding module and of the at least one non-entropy encoding module which has been employed for encoding the additional audio information.

37. An apparatus according to one of claims 24 to 36,

wherein the apparatus is configured to transmit a codebook or a coding tree which has been employed to encode the additional audio information.

38. An apparatus according to claim 37,

wherein the apparatus is configured to transmit an encoding of a structure of the coding tree on which the encoded additional audio information depends.

39. An apparatus according to one of claims 24 to 36,

wherein the apparatus further comprises a memory having stored thereon a codebook or a coding tree,

wherein the at least entropy encoding module is configured to encode the additional audio information using the codebook or using the coding tree.

40. An apparatus according to one of claims 24 to 39,

wherein the at least one entropy encoding module is configured to encode the additional audio information such that the encoded additional audio information comprises a plurality of transmitted symbols and an offset value.

41. An apparatus according to one of claims 24 to 40, further depending on claim 31,

wherein the data for rendering early reflections comprises information on a location of one or more walls, being one or more real walls or virtual walls in an environment.

42. An apparatus according to claim 41,

wherein the information on each wall of the one or more walls comprises information on a azimuth angle and/or an elevation angle of said wall, wherein the azimuth angle of said wall is entropy-encoded and/or the elevation angle of said wall is entropy-encoded, and

wherein one or more entropy encoding modules of the at least one entropy encoding module are configured to encode the additional audio information such that the encoded additional audio information comprises an entropy-encoded azimuth angle of said wall and/or an entropy-encoded elevation angle of said wall.

43. An apparatus according to claim 42, further depending on one of claims 37 to 39,

wherein said one or more entropy encoding modules are configured to encode the entropy-encoded azimuth angle of said wall and/or the entropy-encoded elevation angle of said wall using the codebook or the coding tree.

44. An apparatus according to one of claims 24 to 43,

wherein the encoded additional audio information comprises voxel position information, wherein the position information comprises information on one or more positions of one or more voxels out of a plurality of voxels within a three-dimensional coordinate system.

45. An apparatus according to one of claims 24 to 44,

wherein the at least one entropy encoding module is configured to encode the additional audio information using entropy encoding, wherein the encoded additional audio information comprises at least one of the following:

- a list of triangle indexes,
- an array length of a list of triangle indexes,
- an array with azimuth angles specifying surface normals in spherical coordinates,
- an array with elevation angles specifying surface normals in spherical coordinates,
- an array with distance values,
- an array with positions of a listener,
- an array with positions of one or more sound sources,
- a removal list or a removal set, specifying indices of reflection sequences of a set of reflection sequences that shall be removed or a reference reflection sequence list that shall be removed,
- a number of reflection sequences or a number of reflection paths,

- an array specifying a reflection order,

- reflection sequences.

46. A system comprising:

an apparatus according to one of claims 24 to 45 for encoding one or more audio signals and additional audio information to obtain one or more encoded audio signals and encoded additional audio information, and

an apparatus according to one of claims 1 to 23 for generating one or more audio output signals from the one or more encoded audio signals and depending on the encoded additional audio information.

47. A method for generating one or more audio output signals from one or more encoded audio signals, wherein the method comprises:

decoding encoded additional audio information, when the encoded additional audio information is entropy-encoded, to obtain decoded additional audio information, and

generating the one or more audio output signals depending on the one or more encoded audio signals and depending on the decoded additional audio information.

48. A method for encoding one or more audio signals and additional audio information, wherein the method comprises:

encoding the one or more audio signals to one or more encoded audio signals, and

encoding the additional audio information using entropy encoding to obtain encoded additional audio information.

49. A computer program for implementing the method of claim 47 or 48 when being executed on a computer or signal processor.