Claims

1. Apparatus for generating an enhanced sound field description, comprising:

a sound field generator for generating at least one sound field description indicating a sound field with respect to at least one reference location; and

a meta data generator for generating meta data relating to spatial information of the sound field,

wherein the at least one sound field description and the meta data constitute the enhanced sound field description,

wherein the sound field generator is configured

to generate a first sound field description with respect to the reference location, wherein the first sound field description comprises sound data only from sound sources located in a first volume around the reference location, and

to generate a second sound field description with respect to the reference location, wherein the second sound field description comprises sound data only from second sources located in a second volume around the reference location, the second volume being different from the first volume, and

wherein the meta data generator is configured to provide a spatial description of the first volume and/or the second volume,

or

wherein the apparatus is configured to generate the enhanced sound-field description so that the enhanced sound-field description comprises a first sound-field description, a second sound-field description and a spatial information on the first sound-field description and the second sound-field description as the metadata,

or

wherein the metadata generator is configured to generate, as the metadata a first geometrical information for the first sound-field description, and a second geometrical information for the second sound-field description.

2. Apparatus of claim 1,

wherein the first volume is a sphere around the reference location and wherein the second volume is a spherical shell around the reference location, the spherical shell having a diameter being greater than the diameter of the sphere, or

wherein the first volume is a first spherical shell, and the second volume is a second spherical shell, wherein a diameter of the first spherical shell is lower than a diameter of the second spherical shell,

wherein the meta data generator is configured to provide a spatial description of the sphere and the spherical shell or the first spherical shell and the second spherical shell.

3. Apparatus of claims 1 or 2,

wherein the first sound field description and the second sound field description are Ambisonics or DirAC (Directional Audio Coding) descriptions.

4. Apparatus of one of claims 1 to 3,

wherein the sound field generator is configured to determine the first and the second different volumes statically or dependent on the sound field.

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

wherein the meta data generator is configured to determine a distance range for each sound field description, the distance range being uniform for each volume or non-uniform, wherein, when the distance range is non-uniform for each volume, a

distance range for a volume extending further away from the reference location is greater than a distance range more close to the reference location.

6. Apparatus of one of the preceding claims,

wherein the sound field generator is configured to generate, for each layer of a plurality of layers, a DirAC (Directional Audio Coding) description of a sound field having one or more downmix signals and individual direction data and optionally diffuseness data for different time-frequency bins, and

wherein the meta data generator is configured to generate a single distance information item for each layer.

7. Apparatus of one of the preceding claims, further comprising an output interface for generating an output signal for transmission or storage, the output signal comprising, for a time frame, one or more audio signals derived from the sound field and the spatial information for the time frame.

8. Apparatus of claim 1,

wherein the first geometrical description is a first representative distance from a first volume to a reference point;

wherein the second geometrical information is a second representative distance from a second volume to the reference point, wherein the reference point is the reference location or a vector pointing from the reference location to the reference point.

9. Apparatus for generating a modified sound field description from a sound field description and meta data relating to spatial information of the sound field description, comprising:

a sound field calculator for calculating the modified sound field using the spatial information, the sound field description and a translation information indicating a translation of a reference location to a different reference location
wherein the sound field calculator is configured

to receive, as the sound field description, a first layer sound field description and a second layer sound field description,

to perform a source separation on the first and second layer sound field descriptions, to extract sources of the first and the second layer sound field descriptions and direction of arrival (DoA) data for extracted sources,

to calculate, for each extracted source of the extracted sources, modified DoA data with respect to the different location using the DoA data and the translation information, and

to process the extracted sources and the modified DoA data to obtain the modified sound field description, or

wherein the sound field calculator is configured

to individually perform a source separation for each layer sound field description and to extract an ambience/diffuse/residual signal for each layer, or

to perform the source separation for all layers together and to extract a single ambience/diffuse/residual signal for at least two layers, or

wherein the sound field calculator is configured to calculate, for each source, a modified distance and to calculate a modified layer sound field description using the modified distances of extracted sources, or

wherein the sound field calculator is configured to add, for each component of each layer sound field description, the layer sound field descriptions to obtain an overall sound field description, or

wherein the sound field calculator is configured, for each layer,

to calculate, for a DirAC (Directional Audio Coding) description as the sound field description, modified direction data for different time-frequency bins using the direction data, depth information and the translation information, and

to render the DirAC description using the modified direction data to a sound description comprising a plurality of audio channels or to transmit or store the DirAC description using the modified direction data instead of the direction data for the time-frequency bins, and optionally the same diffuseness data as included in the DirAC description, or

wherein the sound field calculator is configured to determine, for each layer, for a time-frequency bin, to maintain the direction data or to calculate a modified direction data based on diffuseness data for the time frequency bin, wherein a modified direction data is only calculated for the diffuseness data indicating a diffuseness being lower than a predefined or adaptive diffuseness level, or

wherein the sound-field calculator is configured

to receive, for each layer sound-field description, a representative distance for the layer sound-field description from the metadata, and

to determine a scaling value for a source determined from a layer sound-field description using a determination, whether the source remains in the same layer with respect to a new reference position determined by the translation information, wherein the scaling value is determined to be greater than one, if the source is in a lower layer with respect to the different reference location, or wherein the scaling value is determined to be lower than one, if the source is in a higher layer with respect to the different reference location, or

wherein the sound field calculator comprises, for each layer:

a sound field analyzer for analyzing the sound field components to derive, for different frequency bins, direction of arrival information;

a translation transformer for calculating modified direction of arrival information per frequency bin using the direction information and meta data, the meta data comprising a depth map associating a distance information to a layer; and

a distance compensator for calculating the modified sound field using a distance compensation information depending on the distance provided by the depth map for the layer, and a new distance associated with the frequency bin being related to the modified direction of arrival information, or

wherein the sound-field calculator is configured

to analyze each layer sound-field description to obtain a direction of arrival information for each source included in the layer sound-field description,

to determine a distance of a source of the layer sound-field description to a new reference location using the direction of arrival information and the metadata for the layer sound-field description, and

to determine a scaling factor using the distance of the source of the layer sound-field description to the new reference location and the metadata for the sound-field description, from which the source has been extracted, or

wherein the sound-field calculator is configured

to form, for a source, a first vector from the reference location to the source using a direction of arrival information and a geometrical information, wherein the same geometrical information is used for each source in a layer sound-field description,

to form a second vector form the first vector and the translation information for each source in the layer sound-field description, and

to calculate the scaling value for each source by dividing a length of the second vector by a length of the first vector.

10. Apparatus of claim 9,

wherein the sound field calculator is configured

to generate, for each extracted source, a sound field description using the modified DoA (Direction of Arrival) data,

to select sound field descriptions of sound sources based on a distance between the corresponding extracted source and the different reference location for a specific layer and to add the sound field description of each selected source in the layer to obtain a modified layer sound field description, or

to add the sound field description of each source in the sound scene to obtain a modified overall sound field description.

11. Apparatus of claim 10,

wherein the sound field calculator is configured for adding an ambience/diffuse/residual signal for each layer in calculating a modified layer sound field description or to calculate a single ambience/diffuse/residual signal to be added to the overall sound field description.

12. Apparatus of one of claims 9 to 11,

wherein the sound field calculator is configured to apply a rotation to the modified sound field description, the modified sound field description being a layer sound field description or an overall sound field description related to the different reference location.

13. Apparatus of one of claims 9 to 12, further comprising:

a translation interface for providing the translation information or rotation information indicating a rotation of an intended listener for the modified sound field;

a meta data supplier for supplying the meta data to the sound field calculator;

a sound field supplier for supplying the sound field description to the sound field calculator; and

an output interface for outputting the modified sound field comprising the modified sound field description and modified meta data, the modified meta data being derived from the meta data using the translation information, or for outputting a plurality of loudspeaker channels, each loudspeaker channel being related to a predefined loudspeaker position, or for outputting a binaural representation of the modified sound field.

14. Apparatus of one of claims 9 to 13,

wherein the sound field description comprises, for each layer, a plurality of sound field components, the plurality of sound field components comprising an omnidirectional component and at least one directional component.

15. Apparatus of one of claims 9 to 14, wherein the sound field calculator is configured, for each layer,

for calculating a first vector pointing from the reference location to a sound source obtained by the analysis of the sound field;

for calculating a second vector pointing from the different reference location to the sound source using the first vector and the translation information, the translation information defining a translation vector from the reference location to the different reference location; and

for calculating a distance modification value using the different reference location, a location of the sound source, and the second vector, or using a distance from the different reference location to the location of the sound source and the second vector.

16. Apparatus of one of claims 9 to 15,

wherein a first vector is calculated by multiplying a direction of arrival unit vector by a distance included in the meta data, or

wherein a second vector is calculated by subtracting the translation vector from the first vector, or

wherein the distance modification value is calculated by dividing the second vector by a norm of the first vector.

17. Apparatus of one of claims 9 to 16,

wherein the sound field calculator is configured to receive, in addition to the translation information, a rotation information, and

wherein the sound field calculator is configured to perform a rotation transformation to rotate a direction of arrival data for a sound field using the rotation information, wherein the direction of arrival data is derived from a direction of arrival data obtained by a sound field analysis of the sound field description and using the translation information.

18. Apparatus of one of claims 9 to 17, wherein the sound field calculator is configured, for each layer:

to determine sources from the sound field description and directions for the sources by a sound field analysis;

to determine, for each source, a distance of the source from the reference location using the meta data;

to determine a new direction of the source related to the different reference location using the direction for the source and the translation information;

to determine a new distance information for the source related to the different reference location; and

to generate the modified sound field using the new direction of the source, the new distance information, and the sound field description or source signals corresponding to the sources derived from the sound field description.

19. Apparatus of one of claims 9 to 18, wherein the sound field calculator is configured, for each layer:

to determine source signals from the sound field description and directions of the source signals related to the reference location by a sound analysis;

to calculate new directions of the source signals related to the different reference location using the translation information;

to calculate distance information for the sound sources related to the different reference location; and

to synthesize the modified sound field using the distance information, the source signals and the new directions.

20. Apparatus of claim 19, wherein the sound field calculator is configured:

to synthesize the modified sound field by panning a sound source signal to a direction given by the new direction in relation to a replay setup, and

by scaling the sound source signal using the distance information before performing the panning or subsequent to performing the panning.

21. Apparatus of claim 19 or 20,

wherein the sound field calculator is configured to add, for each layer, or only to a single layer, a diffuse signal to a direct part of the sound source signal, the direct part being modified by the distance information before being added to the diffuse signal.

22. Apparatus of one of claims 19 to 21, wherein the sound field calculator is configured, for each layer,

to perform a time-frequency conversion of the sound field description and to calculate a direction of arrival for a plurality of frequency bins of a time frame;

to calculate the new direction for each frequency bins,

to calculate the distance information for each frequency bin, and

to perform a direct synthesis for each frequency bin using an audio signal for a frequency bin, a panning gain for the frequency bin being derived from the new direction for the frequency bin and a scaling value for the frequency bin derived from the distance information for the corresponding layer.

23. Apparatus of claim 22, wherein the sound field calculator is configured, for each layer,

to perform a diffuse synthesis using a diffuse audio signal derived from the audio signal for the frequency bin and using a diffuseness parameter derived by the sound analysis for the frequency bin and to combine the direct part and the diffuse part to obtain a synthesized audio signal for the frequency bin; and

to perform a frequency-time conversion using the audio signals for the frequency bins for a time frame to obtain a time domain synthesized audio signal as the modified sound field.

24. Apparatus of one of claims 19 to 23, wherein the sound field calculator is configured to synthesize, for each sound source, a sound field related to the different reference location, the synthesis comprising:

for each source, processing a source signal using the new direction for the source signal to obtain a sound field description of the source signal related to the different reference location;

modifying the source signal before processing the source signal or modifying the sound field description using the direction information; and

adding the sound field descriptions for the sources to obtain a modified sound field related to the different reference location.

25. Apparatus of one of claims 19 to 24,

wherein the sound analysis is configured to determine the source signals by a source separation algorithm and to subtract at least some of the source signals from the sound field description to obtain the diffuse signal.

26. Apparatus of claim 12,

wherein the sound-field calculator is configured to determine a distance from the new reference location to the position of the source using the position of the source and the translation information, and

to compare the distance to the new reference location to a representative distance of a layer around the different reference location, so that the source is rendered to a layer around the different reference location in accordance with the comparison.

27. Method of generating an enhanced sound field description, comprising:

generating at least one sound field description indicating a sound field with respect to at least one reference location; and

generating meta data relating to spatial information of the sound field,

wherein the at least one sound field description and the meta data constitute the enhanced sound field description,

wherein the generating at least one sound field description comprises generating a first sound field description with respect to the reference location, wherein the first sound field description comprises sound data only from sound sources located in a first volume around the reference location, and generating a second sound field description with respect to the reference location, wherein the second sound field description comprises sound data only from second sources located in a second volume around the reference location, the second volume being different from the first volume, and wherein the generating the meta data comprises providing a spatial description of the first volume and/or the second volume,

or

wherein the method comprise generating the enhanced sound-field description so that the enhanced sound-field description comprises a first sound-field description, a second sound-field description and a spatial information on the first sound-field description and the second sound-field description as the metadata,

or

wherein the generating the meta data comprises generating, as the metadata, a first geometrical information for the first sound-field description, and a second geometrical information for the second sound-field description.

28. Method of generating a modified sound field description from a sound field description and meta data relating to spatial information of the sound field description, the method comprising:

calculating the modified sound field using the spatial information, the sound field description and a translation information indicating a translation from a reference location to a different reference location,

wherein the calculating the modified sound field comprises:

receiving, as the sound field description, a first layer sound field description and a second layer sound field description,

performing a source separation on the first and second layer sound field descriptions, to extract sources of the first and the second layer sound field descriptions and direction of arrival (DoA) data for extracted sources,

calculating, for each extracted source of the extracted sources, modified DoA data with respect to the different location using the DoA data and the translation information, and

processing the extracted sources and the modified DoA data to obtain the modified sound field description, or

wherein the calculating the modified sound field comprises:

individually performing the source separation for each layer sound field description and extracting an ambience/diffuse/residual signal for each layer, or performing the source separation for all layers together and extracting a single ambience/diffuse/residual signal for at least two layers, or

wherein the calculating the modified sound field comprises calculating, for each source, a modified distance and calculating a modified layer sound field description using the modified distances of extracted sources, or

wherein the calculating the modified sound field comprises adding, for each component of each layer sound field description, the layer sound field descriptions to obtain an overall sound field description, or

wherein the calculating the modified sound field comprises, for each layer:

calculating, for a DirAC (Directional Audio Coding) description as the sound field description, modified direction data for different time-frequency bins using the direction data, depth information and the translation information, and

rendering the DirAC description using the modified direction data to a sound description comprising a plurality of audio channels or transmitting or storing the DirAC description using the modified direction data instead of the direction data for the time-frequency bins, and optionally the same diffuseness data as included in the DirAC description, or

wherein the calculating the modified sound field comprises determining, for each layer, for a time-frequency bin, to maintain the direction data or to calculate a modified direction data based on diffuseness data for the time frequency bin, wherein a modified direction data is only calculated for the diffuseness data indicating a diffuseness being lower than a predefined or adaptive diffuseness level, or

wherein the calculating the modified sound field comprises:

receiving, for each layer sound-field description, a representative distance for the layer sound-field description from the metadata, and

determining a scaling value for a source determined from a layer sound-field description using a determination, whether the source remains in the same layer with respect to a new reference position determined by the translation information, wherein the scaling value is determined to be greater than one, if the source is in a lower layer with respect to the different reference location, or wherein the scaling value is determined to be lower than one, if the source is in a higher layer with respect to the different reference location, or

wherein the calculating the modified sound field comprises, for each layer:

analyzing the sound field components to derive, for different frequency bins, direction of arrival information;

calculating modified direction of arrival information per frequency bin using the direction information and meta data, the meta data comprising a depth map associating a distance information to a layer; and

calculating the modified sound field using a distance compensation information depending on the distance provided by the depth map for the layer, and a new distance associated with the frequency bin being related to the modified direction of arrival information, or

wherein the calculating the modified sound field comprises:

analyzing each layer sound-field description to obtain a direction of arrival information for each source included in the layer sound-field description,

determining a distance of a source of the layer sound-field description to a new reference location using the direction of arrival information and the metadata for the layer sound-field description, and

determining a scaling factor using the distance of the source of the layer sound-field description to the new reference location and the metadata for the sound-field description, from which the source has been extracted, or

wherein the calculating the modified sound field comprises:

forming, for a source, a first vector from the reference location to the source using a direction of arrival information and a geometrical information, wherein the same geometrical information is used for each source in a layer sound-field description,

forming a second vector form the first vector and the translation information for each source in the layer sound-field description, and

calculating the scaling value for each source by dividing a length of the second vector by a length of the first vector.

29. Computer program claim for performing, when running on a computer or processor, the method of claim 27 or the method of claim 28.

30. Enhanced sound field description, comprising:

at least one sound field description indicating a sound field with respect to at least one reference location and meta data relating to spatial information of the sound field

wherein the at least one sound field description comprises a first sound field description with respect to the reference location, wherein the first sound field description comprises sound data only from sound sources located in a first volume around the reference location, and a second sound field description with respect to the reference location, wherein the second sound field description comprises sound data only from second sources located in a second volume around the reference location, the second volume being different from the first volume, and

wherein the meta data comprises a spatial description of the first volume and/or the second volume.