Claims

1. Apparatus for reproducing a spatially extended sound source having a defined position and geometry in a space, the apparatus comprising:

an interface for receiving a listener position;

a projector for calculating a projection of a two-dimensional or three-dimensional hull associated with the spatially extended sound source onto a projection plane using the listener position, information on the geometry of the spatially extended sound source, and information on the position of the spatially extended sound source;

a sound position calculator for calculating positions of at least two sound sources for the spatially extended sound source using the projection plane; and

a renderer for rendering the at least two sound sources at the positions of the at least two sound sources to obtain a reproduction of the spatially extended sound source having two or more output signals, wherein the renderer is configured to use different sound signals for the different positions of the at least two sound sources, wherein the different sound signals are associated with the spatially extended sound source.

2. Apparatus of claim 1,

wherein ~~the~~ a detector is configured to detect a momentary listener position in the space using a tracking system, or wherein the interface is configured for using position data input via the interface.

3. Apparatus of claim 1 or 2, configured for receiving a scene description, the scene description comprising the information on the defined position and the information on the defined geometry of the spatially extended sound source, and at least one basis sound signal associated with the spatially extended sound source,

wherein the apparatus further comprises a scene description parser for parsing the scene description to retrieve the information on the defined position, the

information on the defined geometry and the at least one basis sound ~~source~~ signal, or

wherein the scene description comprises, for the spatially extended sound source, at least two basis sound signals and location information for each basis sound signal of the at least two basis sound signals with respect to the information on the geometry of the spatially extended sound source, and wherein the sound position calculator is configured to use the location information for the at least two basis sound signals when calculating the positions of the at least two sound sources using the projection plane.

4. Apparatus of one of the preceding claims,

wherein the projector is configured to compute the hull of the spatially extended sound source using the information on the geometry of the spatially extended sound source and to project the hull in a direction towards ~~the~~ a listener using the listener position to obtain the projection of the two-dimensional or three-dimensional hull onto the projection plane, or

wherein the projector is configured to project a geometry of the spatially extended sound source as defined by the information on the geometry of the spatially extended sound source in a direction towards to the listener position and to calculate the hull of a projected geometry to obtain the projection of the two-dimensional or three-dimensional hull onto the projection plane.

5. Apparatus of one of the preceding claims,

wherein the sound position calculator is configured to calculate the ~~sound source~~ positions of the at least two sound sources in the space from hull projection data and the listener position.

6. Apparatus of one of the preceding claims,

wherein the sound position calculator is configured to calculate the position so that the at least two sound sources are peripheral sound sources and are located on the projection plane, or

wherein the sound position calculator is configured for calculating such that a position of a peripheral sound source of the peripheral sound sources is located on the right of the projection plane with respect to ~~the~~ a listener and/or to the left of the projection plane with respect to the listener, and/or on top of the projection plane with respect to the listener and /or at ~~the~~ a bottom of the projection plane with respect to the listener.

7. Apparatus of one of the preceding claims,

wherein the renderer is configured to render the at least two sound sources using

panning operations depending on the positions of the at least two sound sources to obtain loudspeaker signals for a predefined loudspeaker setup, or

binaural rendering operations using head related transfer functions depending on the positions of the at least two sound sources to obtain headphone signals.

8. Apparatus of one of the preceding claims,

wherein a first number of ~~related~~ basis ~~source~~ sound signals is associated with the spatially extended sound source, the first number being one or greater than one, wherein the ~~related~~ first number of basis ~~source~~ sound signals ~~are~~ is related to the same spatially extended sound source,

wherein the sound position calculator determines a second number of sound sources used for the rendering of the spatially extended sound source, the second number being greater than one, and

wherein the renderer comprises one or more decorrelators for generating a decorrelated signal from one or more basis ~~source~~ sound signals of the first number, ~~when~~ wherein the second number is greater than the first number.

9. Apparatus of one of the preceding claims,

wherein the interface is configured to receive a time-varying position of ~~the~~ a listener in the space,

wherein the projector is configured to calculate a time-varying projection in the space,

wherein the sound position calculator is configured to calculate a time-varying number ~~or~~ of sound sources or time-varying positions of the at least two sound sources in the space, and

wherein the renderer is configured to render the time varying number of sound sources or the at least two sound sources at the time varying positions in the space.

10. Apparatus of one of the preceding claims,

wherein the interface is configured to receive the listener position in six degrees of freedom, and

wherein the projector is configured to calculate the projection depending on the six degrees of freedom.

11. The apparatus of one of the preceding claims, wherein the projector is configured

to calculate the projection as a picture plane such as a plane perpendicular to a sight line of ~~the~~ a listener, or

to calculate the projection as a spherical surface around a head of the listener, or

to calculate the projection as ~~a~~ the projection plane being located at a predetermined distance from a center of the listener's head, or

to calculate the projection of ~~a~~ the ~~convex~~ hull of a spatially extended sound source from an azimuth angle and an elevation angle being derived from spherical coordinates relative to the perspective of a listener's head, the hull being a convex hull.

12. Apparatus of one of the preceding claims,

wherein the sound position calculator is configured to calculate the positions of the at least two sound sources so that the positions are uniformly distributed around the projection of the hull, or so that the positions are placed at extremal or peripheral points of the hull projection, or so that the positions are located at horizontal or vertical extremal or peripheral points of the projection of the hull.

13. Apparatus of one of the preceding claims,

wherein the sound position calculator is configured to determine, in addition to positions for peripheral sound sources, positions for auxiliary sound sources located on or before or behind or within the projection of the hull with respect to the listener.

14. Apparatus of one of the preceding claims,

wherein the projector is configured to additionally shrink the projection of the hull such as towards a center of gravity of the hull or the projection by a variable or predetermined amount or by different variables or predetermined amounts in different directions such as a horizontal direction and a vertical direction.

15. Apparatus of one of the preceding claims, wherein the sound position calculator is configured for calculating such that at least one additional auxiliary sound source is located on the projection plane between a left peripheral sound source and a right peripheral sound source with respect to the listener position, or

wherein the sound position calculator is configured for calculating such that at least one additional auxiliary sound source is located on the projection plane between a left peripheral sound source and a right peripheral sound source with respect to the listener position, wherein a single additional auxiliary source is placed in the middle between the left peripheral sound source and the right peripheral sound source, or two or more additional auxiliary sources are placed equidistantly between the left peripheral sound source and the right peripheral sound source.

16. Apparatus of one of the preceding claims,

wherein the sound position calculator is configured to perform a rotation of the ~~sound~~ positions of the at least two sound sources of the spatially extended sound source preferably around a center of gravity of the projection in case of a receipt of a circular motion of the listener around the spatially extended sound source via the interface, or in case of a receipt of a rotation of the spatially extended sound source with respect a stationary listener via the interface.

17. Apparatus of one of the preceding the claims,

wherein the renderer is configured to receive, for each sound source, an opening angle depending on the distance between the listener and the sound source and to render the sound source depending on the opening angle.

18. Apparatus of one of the preceding claims,

wherein the renderer is configured to receive a distance information for each sound source, and

wherein the renderer is configured to render the sound source depending on the distance so that a sound source being placed closer to the listener is rendered with more volume compared to a sound source being placed less close~~r~~ to the listener and having the same volume.

19. Apparatus of one of the preceding claims, wherein the sound position calculator is configured to

determine, for each sound source, a distance being equal to the distance of the spatially extended sound source with respect to the listener, or

determine a distance of each sound source by a back projection of a location of the sound source on the projection onto the geometry of the spatially extended sound source, and

wherein the renderer is configured to ~~generate~~ render the at least two sound sources using the information on the distance.

20. Apparatus of one of the preceding claims,

wherein the information on the geometry is defined as a one-dimensional line or curve, a two-dimensional area such as an ellipse, a rectangle, or a polygon, or a group of polygons, or a three-dimensional body such an ellipsoid, a cuboid or a polyhedral, and/or

wherein the information is defined as a parametric description or a polygonal description or a parametric representation of the polygonal description.

21. Apparatus of one of the preceding claims,

wherein the sound position calculator is configured to determine a number of sound sources depending on a distance of the listener to the spatially extended sound source, wherein a number of sound sources is higher for a smaller distance compared to a smaller number for a greater distance between the listener and the spatially extended sound source.

22. Apparatus of one of the preceding claims, configured for receiving information on a spreading introduced by ~~-~~the spatially extended sound source, and

wherein the projector is configured to apply a shrinking operation to the hull or the projection using the information on the spreading for at least partly compensating the spreading.

23. Apparatus of one of the preceding claims,

wherein the renderer is configured to render, in case of the positions of the at least two sound sources being identical to each other within a defined tolerance range, the sound sources by combining basis signals associated with the spatially extended sound source ~~for example using a Givens rotation~~ to obtain rotated basis signals and to render the rotated basis signals at the positions of the at least two sound sources.

24. Apparatus of one of the preceding claims,

wherein the renderer is configured to perform a preprocessing or a post-processing, when generating the at least two sound sources in accordance with a position- or direction-dependent characteristic.

25. Apparatus of one of the preceding claims,

wherein the spatially extended sound source has, as the information on the geometry, an information that the spatially extended sound source is a spherical, and ellipsoid, a line, a cuboid or a piano-shape spatially extended sound source.

26. Apparatus of one of the preceding claims, configured for

receiving a bitstream representing a compressed description for the spatially extended sound source, the bitstream comprising a bitstream element indicating a first number of different sound signals for the spatially extended sound source included in the bitstream or an encoded audio signal received by the apparatus, the number being one or greater than one,

reading the bitstream element and retrieving the first number of different sound signals for the spatially extended sound source included in the bitstream or in the encoded audio signal, and

wherein the sound position calculator determines a second number of sound sources used for the rendering of the spatially extended sound source, the second number being greater than one, and

wherein the renderer is configured to generate, depending on the first number extracted from the bitstream, a third number of one or more decorrelated signals, the third number being derived from a difference between the second number and the third number.

~~27. Apparatus for generating a bitstream representing a compressed description for a spatially extended sound source, the apparatus comprising:~~

~~a sound provider for providing one or more different sound signals for the spatially extended sound source;~~

~~a geometry provider for calculating information on a geometry for the spatially extended sound source; and~~

~~an output data former for generating the bitstream representing the compressed sound scene, the bitstream comprising the one or more different sound signals, and the information on the geometry.~~

~~28. Apparatus of claim 27, wherein the information on the geometry comprises position information indicating a position of the spatially extended sound source in a space.~~

~~29. Apparatus of claim 27 or 28, comprising:~~

~~wherein the output data former is configured for introducing, into the bitstream, an information on the individual location for each sound signal of the one or more different sound signals such that the information on the individual location indicates the location of the corresponding sound signal.~~

~~30. Apparatus of claim 27, 28, or 29, wherein the sound provider is configured for providing at least two different sound signals for the spatially extended sound source, and wherein the output data former is configured for generating the bitstream so that the bitstream comprises the at least two different sound signals and the individual location information for each sound signal of the at least two different sound signals with respect to the information on the geometry of the spatially extended sound source.~~

~~31. Apparatus of one of claims 27 to 30, wherein the sound provider is configured~~

~~to perform a recording of a natural sound source at a single or multiple microphone positions or orientations, or~~

~~to derive a sound signal from a single or several basis signals by one or more decorrelation filters.~~

~~32. Apparatus of one of claims 27 to 31,~~

~~wherein the sound provider is configured to bit-rate compress the one or more sound signals using an audio signal encoder, and~~

~~wherein the output data former is configured to use the bit-rate compressed one or more sound signals for the spatially extended sound source.~~

~~33. Apparatus of one of claims 27 to 32, wherein the geometry provider is configured to derive, from a geometry of the spatially extended sound source, a parametric description or a polygonal description or a parametric representation of the polygonal description, and wherein the output data former is configured to introduce, into the bitstream, the parametric description or the polygonal description or the parametric representation of the polygonal description as the informationon the geometry.~~

~~34. Apparatus of one of claims 27 to 33, wherein the output data former is configured to introduce, into the bitstream, a bitstream element indicating a number of the one or more different sound signals for the spatially extended sound source included in the bitstream or included in an encoded audio signal associated with the bitstream, the number being one or greater than one.~~

~~35~~27. Method for reproducing a spatially extended sound source having a defined position and geometry in a space, the method comprising:

receiving a listener position;

calculating a projection of a two-dimensional or three-dimensional hull associated with the spatially extended sound source onto a projection plane using the listener position, information on the geometry of the spatially extended sound source, and information on the position of the spatially extended sound source;

calculating positions of at least two sound sources for the spatially extended sound source using the projection plane; and

rendering the at least two sound sources at the positions of the at least two sound sources to obtain a reproduction of the spatially extended sound source having two or more output signals, wherein the rendering comprises using different sound signals for the different positions of the at least two sound sources, wherein the different sound signals are associated with the spatially extended sound source.

36. Method of generating a bitstream representing a compressed description for a spatially extended sound source, the method comprising:

providing one or more different sound signals for the spatially extended sound source;

providing information on a geometry for the spatially extended sound source; and

generating the bitstream representing the compressed sound scene, the bitstream comprising the one or more different sound signals, and the information on the geometry for the spatially extended sound source.

37. Method of claim 36, wherein the information on the geometry for the spatially extended sound source comprises position information of the spatially extended sound source in a space.

38. Method of claim 36 or 37,

wherein the generating the bitstream comprises introducing, into the bitstream, information on the individual location for each sound signal of the one or more different sound signals.

39. Method of claim 36, 37, or 38, wherein the providing comprises providing at least two different sound signals for the spatially extended sound source, and wherein the generating the bitstream is performed so that the bitstream comprises the at least two different sound signals and the individual location information for each sound signal of the at least two different sound signals such that the information indicates the location of the corresponding sound signal with respect to the information on the geometry of the spatially extended sound source.

40. Method of one of claims 36 to 39, wherein the generating the bitstream comprises introducing, into the bitstream, a bitstream element indicating a number of the one or more different sound signals for the spatially extended sound source included in the bitstream or included in an encoded audio signal associated with the bitstream, the number being one or greater than one

41. Bitstream representing a compressed description for a spatially extended sound source, comprising:

at least two different sound signals for the spatially extended sound source;

information on a geometry for the spatially extended sound source,

first location information for a first sound signal of the at least two different sound signals indicating a first location of the first sound signal with respect to the information on the geometry of the spatially extended sound source; and

second location information for a second sound signal of the at least two different sound signals indicating a second location of the second sound signal with respect to the information on the geometry of the spatially extended sound source, the second location information being different from the first location information.

44. Bitstream of claim 41, 42, or 43, wherein the information on the geometry of the spatially extended sound source comprises position information of the spatially extended sound source.

45. Bitstream of one of claims 41 to 44, comprising:

first location information for a first sound signal indicating a first location of the corresponding sound signal with respect to the information on the geometry of the spatially extended sound source; and

second location information for a second sound signal indicating a second location of the corresponding sound signal with respect to the information on the geometry of the spatially extended sound source, the second location information being different from the first location information.

46. Bitstream of one of claims 40 to 45, further comprising a bitstream element indicating a number of the at least one different sound signalsfor the spatially extended sound source included in the bitstream or included in an encoded audio signal associated with the bitstream, the number being one or greater than one.

~~47~~28. Computer program for performing, when running on a computer or a processor, the method of ~~any one of~~ claim~~s~~ ~~35~~27 ~~to 40~~.