

CLAIMS

1. A method of processing position information indicative of an object position of an audio object, wherein the object position is usable for rendering of the audio object, the
5 method comprising:

obtaining listener orientation information indicative of an orientation of a listener's head;

obtaining listener displacement information indicative of a displacement of the listener's head;

10 determining the object position from the position information;

modifying the object position based on the listener displacement information by applying a translation to the object position; and

further modifying the modified object position based on the listener orientation information.

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2. The method according to claim 1, wherein:

modifying the object position and further modifying the modified object position is performed such that the audio object, after being rendered to one or more real or virtual speakers in accordance with the further modified object position, is psychoacoustically
20 perceived by the listener as originating from a fixed position relative to a nominal listening position, regardless of the displacement of the listener's head from the nominal listening position and the orientation of the listener's head with respect to a nominal orientation.

3. The method according to claim 1 or 2, wherein:

25 modifying the object position based on the listener displacement information is performed by translating the object position by a vector that positively correlates to magnitude and negatively correlates to direction of a vector of displacement of the listener's head from a nominal listening position.

30 4. The method according to any one of claims 1 to 3 , wherein:

the listener displacement information is indicative of a displacement of the listener's head from a nominal listening position by a small positional displacement.

5. The method according to any one of claims 1 to 4, wherein:

5 the listener displacement information is indicative of a displacement of the listener's head from a nominal listening position that is achievable by the listener moving their upper body and/or head.

6. The method according to any one of claims 1 to 5, wherein:

10 the position information comprises an indication of a distance of the audio object from a nominal listening position.

7. The method according to any one of claims 1 to 6, wherein:

15 the listener orientation information comprises information on a yaw, a pitch, and a roll of the listener's head.

8. The method according to any one of claims 1 to 7, wherein:

20 the listener displacement information comprises information on the listener's head displacement from a nominal listening position expressed in Cartesian coordinates or in spherical coordinates.

9. The method according to any one of claims 1 to 8, further comprising:

25 detecting the orientation of the listener's head by wearable and/or stationary equipment.

10. The method according to any one of claims 1 to 9, further comprising:

 detecting the displacement of the listener's head from a nominal listening position by wearable and/or stationary equipment.

30 11. The method according to any one of claims 1 to 10, further comprising:

rendering the audio object to one or more real or virtual speakers in accordance with the further modified object position.

12. The method according to claim 11, wherein:

5 the rendering is performed to take into account sonic occlusion for small distances of the audio object from the listener's head, based on head-related transfer functions, HRTFs, for the listener's head.

13. The method according to claim 11 or 12, wherein:

10 the further modified object position is adjusted to the input format used by an MPEG-H 3D Audio renderer.

14. The method according to any one of claims 11 to 13, wherein:

the rendering is performed using an MPEG-H 3D Audio renderer.

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15. The method according to any one of claims 1 to 14, wherein:

the processing is performed using an MPEG-H 3D Audio decoder.

16. The method according to any one of claims 1 to 15, wherein:

20 the processing is performed by a scene displacement unit of an MPEG-H 3D Audio decoder.

17. A method of processing position information indicative of an object position of an audio object, wherein the object position is usable for rendering of the audio object, the method comprising:

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obtaining listener displacement information indicative of a displacement of the listener's head;

determining the object position from the position information; and

modifying the object position based on the listener displacement information by

30 applying a translation to the object position.

18. The method according to claim 17, wherein:

modifying the object position based on the listener displacement information is performed such that the audio object, after being rendered to one or more real or virtual speakers in accordance with the modified object position, is psychoacoustically perceived by the listener as originating from a fixed position relative to a nominal listening position, regardless of the displacement of the listener's head from the nominal listening position.

19. The method according to claim 17 or 18, wherein:

modifying the object position based on the listener displacement information is performed by translating the object position by a vector that positively correlates to magnitude and negatively correlates to direction of a vector of displacement of the listener's head from a nominal listening position.

20. A method of processing position information indicative of an object position of an audio object, wherein the object position is usable for rendering of the audio object, the method comprising:

obtaining listener orientation information indicative of an orientation of a listener's head;
determining the object position from the position information; and
modifying the object position based on the listener orientation information.

21. The method according to claim 20, wherein:

modifying the object position based on the listener orientation information is performed such that the audio object, after being rendered to one or more real or virtual speakers in accordance with the modified object position, is psychoacoustically perceived by the listener as originating from a fixed position relative to a nominal listening position, regardless of the orientation of the listener's head with respect to a nominal orientation.

22. An apparatus for processing position information indicative of an object position of an audio object, wherein the object position is usable for rendering of the audio object, the

apparatus comprising a processor and a memory coupled to the processor, wherein the processor is adapted to:

- obtain listener orientation information indicative of an orientation of a listener's head;
- obtain listener displacement information indicative of a displacement of the listener's
- 5 head;
- determine the object position from the position information;
- modify the object position based on the listener displacement information by applying a translation to the object position; and
- further modify the modified object position based on the listener orientation
- 10 information.

23. The apparatus according to claim 22, wherein:

- the processor is adapted to modify the object position and further modify the modified
- object position such that the audio object, after being rendered to one or more real or virtual
- 15 speakers in accordance with the further modified object position, is psychoacoustically
- perceived by the listener as originating from a fixed position relative to a nominal listening
- position, regardless of the displacement of the listener's head from the nominal listening
- position and the orientation of the listener's head with respect to a nominal orientation.

24. The apparatus according to claim 22 or 23, wherein:

- the processor is adapted to modify the object position based on the listener
- displacement information by translating the object position by a vector that positively
- correlates to magnitude and negatively correlates to direction of a vector of displacement of
- the listener's head from a nominal listening position.

25. The apparatus according to any one of claims 22 to 24, wherein:

- the listener displacement information is indicative of a displacement of the listener's
- head from a nominal listening position by a small positional displacement.

26. The apparatus according to any one of claims 22 to 25, wherein:

the listener displacement information is indicative of a displacement of the listener's head from a nominal listening position that is achievable by the listener moving their upper body and/or head.

5 27. The apparatus according to any one of claims 22 to 26, wherein:
the position information comprises an indication of a distance of the audio object from a nominal listening position.

28. The apparatus according to any one of claims 22 to 27, wherein:
10 the listener orientation information comprises information on a yaw, a pitch, and a roll of the listener's head.

29. The apparatus according to any one of claims 22 to 28, wherein:
the listener displacement information comprises information on the listener's head
15 displacement from a nominal listening position expressed in Cartesian coordinates or in spherical coordinates.

30. The apparatus according to any one of claims 22 to 29, further comprising:
wearable and/or stationary equipment for detecting the orientation of the listener's
20 head.

31. The apparatus according to any one of claims 22 to 30, further comprising:
wearable and/or stationary equipment for detecting the displacement of the listener's
head from a nominal listening position.

25 32. The apparatus according to any one of claims 22 to 31, wherein:
the processor is further adapted to render the audio object to one or more real or virtual speakers in accordance with the further modified object position.

30 33. The apparatus according to claim 32, wherein:

the processor is adapted to perform the rendering taking into account sonic occlusion for small distances of the audio object from the listener's head, based on head-related transfer functions, HRTFs, for the listener's head.

5 34. The apparatus according to claim 32 or 33, wherein:

the processor is adapted to adjust the further modified object position to the input format used by an MPEG-H 3D Audio renderer.

10 35. The apparatus according to any one of claims 32 to 34, wherein:

the rendering is performed using an MPEG-H 3D Audio renderer.

36. The apparatus according to any one of claims 22 to 35, wherein:

the processor is adapted to implement an MPEG-H 3D Audio decoder.

15 37. The apparatus according to any one of claims 22 to 36, wherein:

the processor is adapted to implement a scene displacement unit of an MPEG-H 3D Audio decoder.

20 38. An apparatus for processing position information indicative of an object position of an audio object, wherein the object position is usable for rendering of the audio object, the apparatus comprising a processor and a memory coupled to the processor, wherein the processor is adapted to:

obtain listener displacement information indicative of a displacement of the listener's head;

25 determine the object position from the position information; and

modify the object position based on the listener displacement information by applying a translation to the object position.

39. The apparatus according to claim 38, wherein:

30 the processor is adapted to modify the object position based on the listener displacement information such that the audio object, after being rendered to one or more real

or virtual speakers in accordance with the modified object position, is psychoacoustically perceived by the listener as originating from a fixed position relative to a nominal listening position, regardless of the displacement of the listener's head from the nominal listening position.

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40. The apparatus according to claim 38 or 39, wherein:

the processor is adapted to modify the object position based on the listener displacement information by translating the object position by a vector that positively correlates to magnitude and negatively correlates to direction of a vector of displacement of the listener's head from a nominal listening position.

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41. An apparatus for processing position information indicative of an object position of an audio object, wherein the object position is usable for rendering of the audio object, the apparatus comprising a processor and a memory coupled to the processor, wherein the processor is adapted to:

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obtain listener orientation information indicative of an orientation of a listener's head; determine the object position from the position information; and modify the object position based on the listener orientation information.

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42. The apparatus according to claim 41, wherein:

the processor is adapted to modify the object position based on the listener orientation information such that the audio object, after being rendered to one or more real or virtual speakers in accordance with the modified object position, is psychoacoustically perceived by the listener as originating from a fixed position relative to a nominal listening position, regardless of the orientation of the listener's head with respect to a nominal orientation.

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43. A system of an apparatus according to any one of claims 22 to 37 and wearable and/or stationary equipment capable of detecting an orientation of a listener's head and detecting a displacement of the listener's head.

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44. The method according to any one of claims 1 to 16, wherein modifying the object position is further based on a modified radius r' .

45. The method of claim 44, wherein the modified radius r' is determined based on:

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$$r' = (r^2 + r_{\text{offset}}^2)^{1/2},$$

wherein r indicates an initial radius parameter and r_{offset} indicates a norm of positional displacement of the listener's head from a nominal listening position.

46. The method of claim 16, wherein, during headphone and/or loudspeaker
10 reproduction, the scene displacement unit is enabled.

47. The method of any one of claims 17 to 19, wherein the modifying the object position based on the listener displacement information is further based on a modified radius r' .

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48. The method of claim 47, wherein the modified radius r' is determined based on:

$$r' = (r^2 + r_{\text{offset}}^2)^{1/2},$$

wherein r indicates an initial radius parameter and r_{offset} indicates a norm of positional displacement of the listener's head from a nominal listening position.

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49. The method of claim 20 or 21, wherein modifying the object position based on the listener orientation information is further based on a modified radius r' .

50. The method of claim 49, wherein the modified radius r' is determined based on:

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$$r' = (r^2 + r_{\text{offset}}^2)^{1/2},$$

wherein r indicates an initial radius parameter and r_{offset} indicates a norm of positional displacement of the listener's head from a nominal listening position.

51. The apparatus of any one of claims 22 to 37, wherein the processor is adapted to modify the modified object position based on the listener orientation information and further based on a modified radius r' .

5 52. The apparatus of claim 51, wherein the processor is adapted to determine the modified radius r' based on:

$$r' = (r^2 + r_{\text{offset}}^2)^{1/2},$$

wherein r indicates an initial radius parameter and r_{offset} indicates a norm of positional displacement of the listener's head from a nominal listening position.

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53. The apparatus of claim 37, wherein the processor is adapted to, during headphone and/or loudspeaker reproduction, enable the scene displacement unit.

54. The apparatus of any one of claims 38 to 40, wherein the processor is adapted
15 to modify the object position based on the listener displacement information and further based on a modified radius r' .

55. The apparatus of claim 54, wherein the processor is adapted to determine the radius r' based on:

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$$r' = (r^2 + r_{\text{offset}}^2)^{1/2},$$

wherein r indicates an initial radius parameter and r_{offset} indicates a norm of positional displacement of the listener's head from a nominal listening position.

56. The apparatus of claim 41 or 42, wherein the processor is adapted to modify the
25 object position based on the listener orientation information further based on a modified radius r' .

57. The apparatus of claim 56, wherein the processor is adapted to determine the radius r' based on:

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$$r' = (r^2 + r_{\text{offset}}^2)^{1/2},$$

wherein r indicates an initial radius parameter and r_{offset} indicates a norm of positional displacement of the listener's head from a nominal listening position.