Claims

1. An audio processor for providing a plurality of loudspeaker signals on the basis of a plurality of input signals,

wherein the audio processor is configured to obtain an information about a position of a listener;

wherein the audio processor is configured to obtain an information about positions of a plurality of loudspeakers;

wherein the audio signal processor is configured to select one or more loudspeakers for a rendering of objects and/or of channel objects and/or of adapted signals derived from the input signals, in dependence on the information about the position of the listener, in dependence on the information about positions of the plurality of loudspeakers and taking into consideration an information about one or more acoustic obstacles;

wherein the audio signal processor is configured to render the objects and/or the channel objects and/or the adapted signals derived from the input signals, in dependence on the information about the position of the listener and in dependence on the information about positions of the plurality of loudspeakers, in order to obtain the plurality of loudspeaker signals such that a rendered sound follows the listener when the listener moves or turns; and

wherein the audio signal processor is configured to apply a first approach, where perceived absolute positions of the objects and/or the channel objects and/or the adapted signals derived from the input signals remain unchanged, and a second approach, where perceived audio objects are keeping their relative positions to the listener, when the listener changes his/her position and/or his/her orientation, according to one or more rules.

2. The audio processor according to claim 1, wherein the audio processor is configured to obtain an information about positions and/or acoustic characteristics of acoustic obstacles in an environment around the loudspeaker(s).

3. The audio processor according to the claim 1 or 2,

wherein the audio processor is configured to obtain an information about an orientation of the listener;

wherein the audio signal processor is configured to dynamically allocate loudspeakers for playing back the objects and/or the channel objects and/or the adapted signals derived from the input signals, in dependence on the information about the orientation of the listener;

wherein the audio signal processor is configured to render the objects and/or the channel objects and/or the adapted signals derived from the input signals, in dependence on the information about the orientation of the listener, in order to obtain the loudspeaker signals such that the rendered sound follows the orientation of the listener.

4. The audio processor according to one of the claims 1 to 3,

wherein the audio processor is configured to obtain an information about an orientation and/or about a characteristic and/or about a specification of the loudspeakers;

wherein the audio signal processor is configured to dynamically allocate the loudspeakers for playing the objects and/or the channel objects and/or the adapted signals derived from the input signals, in dependence on the information about the orientation and/or about the characteristic and/or about the specification of the loudspeakers;

wherein the audio signal processor is configured to render the objects and/or the channel objects and/or the adapted signals derived from the input signals, in dependence on the information about the orientation and/or about the characteristic and/or about the specification of the loudspeakers, in order to obtain the loudspeaker signals such that the rendered sound follows the listener and/or the orientation of the listener when the listener moves or turns.

5. The audio processor according to one of the claims 1 to 4,

wherein the audio signal processor is configured to dynamically change an allocation of loudspeakers for playing back the objects, the channel objects, or the adapted signals derived from the input signals

from a first situation in which the objects and/or the channel objects and/or the adapted signals of an input signal are allocated to a first loudspeaker setup corresponding to a channel configuration of a channel-based input signal

to a second situation in which the objects and/or the channel objects and/or the adapted signals of the input signal are allocated to a subset of the loudspeakers of the first loudspeaker setup and to at least one additional loudspeaker.

6. The audio processor according to one of the claims 1 to 5,

wherein the audio signal processor is configured to dynamically change an allocation of loudspeakers for playing back the objects and/or the channel objects and/or the adapted signals derived from the input signals

from a first situation in which the objects and/or the channel objects and/or the adapted signals of the input signal are allocated to a first loudspeaker setup corresponding to a channel configuration of a channel-based input signal with a first loudspeaker layout

to a second situation in which the objects and/or the channel objects and/or the adapted signals of the input signal are allocated to a second loudspeaker setup, which corresponds to the channel configuration of the channel-based input signal, with a second loudspeaker layout, and

wherein the first loudspeaker setup and the second loudspeaker setup are separated by an acoustic obstacle or acoustic obstacles.

7. The audio processor according to one of the claims 1 to 6,

wherein the audio signal processor is configured to dynamically allocate loudspeakers of a first loudspeaker setup for playing back the objects and/or the channel objects and/or the adapted signals derived from the input signals, according to a first allocation scheme, in agreement with a first loudspeaker layout, and

wherein the audio processor is configured to dynamically allocate loudspeakers of a second loudspeaker setup for playing back the objects and/or the channel objects and/or the adapted signals derived from the input signals, according to a second allocation

scheme in agreement with a second loudspeaker layout, which differs from the first loudspeaker layout, and

wherein the first loudspeaker setup and the second loudspeaker setup are separated by an acoustic obstacle or acoustic obstacles.

8. The audio processor according to one of the claims 3 to 7,

wherein a loudspeaker setup corresponds to a channel configuration of the input signal, and

wherein the audio processor is configured to dynamically allocate loudspeakers of the loudspeaker setup for playing back the objects and/or the channel objects and/or the adapted signals, such that the allocation deviates from the correspondence, in response to a difference between the listener's position and/or orientation from a default listener's position and/or orientation associated with the loudspeaker setup and taking into consideration an information about one or more acoustic obstacles.

9. The audio processor according to one of the claims 1 to 8,

wherein a first loudspeaker setup corresponds to a channel configuration according to a first correspondence, and

wherein the audio processor is configured to dynamically allocate loudspeakers of the first loudspeaker setup for playing back the objects and/or the channel objects and/or the adapted signals, according to this first correspondence, and

wherein a second loudspeaker setup corresponds to a channel configuration according to a second correspondence, and

wherein the audio processor is configured to dynamically allocate loudspeakers of the second loudspeaker setup for playing back the objects and/or the channel objects and/or the adapted signals to, such that the allocation to loudspeakers deviates from this second correspondence, and

wherein the first loudspeaker setup and the second loudspeaker setup are separated by an acoustic obstacle.

10. The audio processor according to one of the claims 1 to 9, wherein the audio processor is configured to dynamically allocate a subset of all the loudspeakers of all loudspeaker setups for playing the objects and/or the channel objects and/or the adapted signals derived from the input signals.

11. The audio processor according to claim 10, wherein the audio processor is configured to dynamically allocate a subset of all the loudspeakers of all the loudspeaker setups for playing back the objects and/or the channel objects and/or the adapted signals derived from the input signals,

wherein the audio processor is configured to select a subset of all available loudspeakers, such that the listener is located between or amongst the selected loudspeakers, such that the subset of the loudspeakers surrounds the listener.

12. The audio processor according to one of the claims 1 to 11, wherein the audio processor is configured to render the objects and/or the channel objects and/or the adapted signals derived from the input signals with defined follow times, such that, a sound image follows the listener in a way that the rendering is adapted smoothly over time.

13. The audio processor according to one of the claims 1 to 12, wherein the audio processor is configured

to identify loudspeakers in a predetermined environment of the listener, and

to adapt a configuration of the input signals to the number of identified speakers, and

to dynamically allocate the identified loudspeakers for playing back the objects and/or the channel objects and/or the adapted signals, and

to render objects and/or channel objects and/or adapted signals to loudspeaker signals of associated loudspeakers in dependence on position information of objects and/or channel objects and/or adapted signals and in dependence on a default loudspeaker position and taking into consideration information about one or more acoustic obstacles.

14. The audio processor according to one of the claims 3 to 13, wherein the audio processor is configured to compute a position of objects and/or channel objects on a basis of information about the position and/or the orientation of the listener.

15. The audio processor according to one of the claims 1 to 14, wherein the audio processor is configured to physically compensate the rendered objects and/or the channel objects and/or the adapted signals in dependence on a default loudspeaker position, on the actual loudspeaker position, and on the relationship between a sweet spot and the listener's position and taking into consideration information about one or more acoustic obstacles.

16. The audio processor according to one of the claims 1 to 15, wherein the audio processor is configured to dynamically allocate one or more loudspeakers for playing back the objects and/or the channel objects and/or the adapted signals, in dependence on distances between the position of the objects and/or of the channel objects and/or of the adapted signals and the loudspeakers.

17. The audio processor according to one of the claims 1 to 16, wherein the audio processor is configured to dynamically allocate one or more loudspeakers having a smallest distance or smallest distances from an absolute position of the objects and/or the channel objects and/or the adapted signals for playing back the objects and/or channel objects and/or adapted signals.

18. The audio processor according to one of the claims 1 to 17, wherein the input signal is having an ambisonics and/or Higher Order Ambisonics and/or Binaural format.

19. The audio processor according to one of the claims 1 to 18, wherein the audio processor is configured to dynamically allocate loudspeakers for playing back the objects and/or channel objects and/or adapted signals, such that a sound image of the objects and/or channel objects and/or adapted signals follow a movement of the listener.

20. The audio processor according to one of the claims 3 to 19, wherein the audio processor is configured to dynamically allocate loudspeakers for playing back the objects and/or the channel objects and/or the adapted signals, such that a sound image of the objects and/or the channel objects and/or the adapted signals follow a change of the listener's position and a change of a listener's orientation.

21. The audio processor according to one of the claims 1 to 20, wherein the audio processor is configured to dynamically allocate loudspeakers for playing back the objects and/or channel objects and/or adapted signals, such that a sound image of the objects and/or channel objects and/or adapted signals follows a change of the listener's position, but remains stable against changes of the listener's orientation.

22. The audio processor according to one of the claims 1 to 21, wherein the audio processor is configured to dynamically allocate loudspeakers for playing back the objects and/or channel objects and/or adapted signals, in dependence on information about positions of two or more listeners, such that a sound image of the objects and/or channel objects and/or adapted signals is adapted depending on a movement or turn of two or more listeners, considering the one or more acoustic obstacles.

23. The audio processor according to claim 22, wherein the audio processor is configured to track the position of the one or more listeners in real-time.

24. The audio processor according to one of the claims 1 to 23, wherein the audio processor is configured to fade a sound image between two or more loudspeaker setups in dependence on the positional coordinates of the listener, such that an actual fading ratio is dependent on the actual position of the listener or on an actual movement of the listener, and

wherein the two or more loudspeaker setups are separated by acoustic obstacles.

25. The audio processor according to one of the claims 1 to 24, wherein the audio processor is configured to fade the sound image from a first loudspeaker setup to a second loudspeaker setup, wherein a number of loudspeakers of the second loudspeaker setup is different from a number of loudspeakers of the first loudspeaker setup, and

wherein the first loudspeaker setup and the second loudspeaker setup are separated by one or more acoustic obstacles.

26. The audio processor according to one of the claims 1 to 25, wherein the audio processor is configured to adaptively upmix or downmix the objects and/or channel objects, in dependence on the number of the objects and/or channel object in the input signal and in dependence on the number of allocated loudspeakers, in order to obtain dynamically adapted signals.

27. The audio processor according to one of the claims 1 to 26, wherein the audio processor is configured to transition

from a first state, in which a audio content is rendered to a first loudspeaker setup,

to a second state in which an ambient sound of the audio content is rendered to the first loudspeaker setup, or to one or more loudspeakers of the first loudspeaker setup, while directional components of the audio content are rendered to the second loudspeaker setup, and

wherein the first loudspeaker setup and the second loudspeaker setup are separated by acoustic obstacles.

28. The audio processor according to one of the claims 1 to 27, wherein the audio processor is configured to transition

from a first state, in which an audio content is rendered to a first loudspeaker setup,

to a second state in which an ambient sound of the audio content and directional components of the audio content are rendered to different loudspeakers in the second loudspeaker setup, and

wherein the first loudspeaker setup and the second loudspeaker setup are separated by acoustic obstacles.

29. The audio processor according to one of the claims 1 to 28, wherein the audio processor is configured to associate a position information to an audio channel of a channel-based audio content, in order to obtain a channel object, wherein the position information represents a position of a loudspeaker associated with the audio channel.

30. The audio processor according to one of the claims 1 to 29, wherein the audio processor is configured to dynamically allocate a given single loudspeaker for playing back the objects and/or channel objects and/or adapted signals, which comprises a best acoustic path to the listener, as long as a listener is within a predetermined distance range from the given single loudspeaker.

31. The audio processor according to claim 30, wherein the audio processor is configured to fade out a signal of the given single loudspeaker, in response to a detection that the listener leaves the predetermined range and/or is shadowed from the loudspeaker by an obstacle.

32. The audio processor according to one of the claims 1 to 31, wherein the audio processor is configured to decide, to which loudspeaker signals the objects and/or channel objects and/or adapted signals are rendered in dependence on a distance of two loudspeakers and/or in dependence on an angle between the two loudspeakers from a listener's position and taking into consideration information about one or more acoustic obstacles.

33. A method for providing a plurality of loudspeaker signals on the basis of a plurality of input signals,

wherein the method comprises obtaining an information about a position of a listener;

wherein the method comprises obtaining an information about positions of a plurality of loudspeakers;

wherein one or more loudspeakers are selected for rendering the objects and/or the channel objects and/or the adapted signals derived from the input signals, in dependence on the information about the position of the listener, in dependence on the information about positions of the loudspeakers and taking into consideration an information about one or more acoustic obstacles;

wherein the objects and/or the channel objects and/or the adapted signals derived from the input signals are rendered, in dependence on the information about the position of the listener and in dependence on the information about positions of the loudspeakers, in order to obtain the loudspeaker signals such that the rendered sound follows the listener when the listener moves or turns; and

wherein the method comprises applying a first approach, where perceived absolute positions of the objects and/or the channel objects and/or the adapted signals derived from the input signals remain unchanged, and a second approach, where perceived audio objects are keeping their relative positions to the listener, when the listener changes his/her position and/or his/her orientation, according to one or more rules..

34. Computer program with a program code for performing the methods according to claim 33, when the computer program runs on a computer.

35. An audio processor for providing a plurality of loudspeaker signals on the basis of a plurality of input signals,

wherein the audio processor is configured to obtain an information about a position of a listener;

wherein the audio processor is configured to obtain an information about positions of a plurality of loudspeakers;

wherein the audio signal processor is configured to select one or more loudspeakers for a rendering of objects and/or of channel objects and/or of adapted signals derived from the input signals, in dependence on the information about the position of the listener, in dependence on the information about positions of the loudspeakers and taking into consideration an information about one or more acoustic obstacles;

wherein the audio signal processor is configured to render the objects and/or the channel objects and/or the adapted signals derived from the input signals, in dependence on the information about the position of the listener and in dependence on the information about positions of the loudspeakers, in order to obtain the loudspeaker signals such that a rendered sound follows the listener when the listener moves or turns;

wherein the audio processor is configured to render the objects and/or channel objects and/or adapted signals derived from the input signals with defined follow times, that is changes do not happen immediately, but the translational or rotational changes, or a combination of both, adapts within adjustable time constants to the new listener position, such that, the sound image follows the listener in a way that the rendering is adapted smoothly over time.

36. An audio processor for providing a plurality of loudspeaker signals on the basis of a plurality of input signals,

wherein the audio processor is configured to obtain an information about a position of a listener;

wherein the audio processor is configured to obtain an information about positions of a plurality of loudspeakers;

wherein the audio signal processor is configured to select one or more loudspeakers for a rendering of objects and/or of channel objects and/or of adapted signals derived from the input signals, in dependence on the information about the position of the listener, in dependence on the information about positions of the loudspeakers and taking into consideration an information about one or more acoustic obstacles;

wherein the audio signal processor is configured to render the objects and/or the channel objects and/or the adapted signals derived from the input signals, in dependence on the information about the position of the listener and in dependence on the information about positions of the loudspeakers, in order to obtain the loudspeaker signals such that a rendered sound follows the listener when the listener moves or turns; and

wherein the audio signal processor is configured to calculate an effective distance by correcting the distance between the listener and the loudspeakers by an acoustic attenuation or an acoustical transmission coefficient of the acoustic obstacles between the listener and the loudspeakers.

37. An audio processor for providing a plurality of loudspeaker signals on the basis of a plurality of input signals,

wherein the audio processor is configured to obtain an information about a position of a listener;

wherein the audio processor is configured to obtain an information about positions of a plurality of loudspeakers;

wherein the audio signal processor is configured to select one or more loudspeakers for a rendering of objects and/or of channel objects and/or of adapted signals derived from the input signals, in dependence on the information about the position of the listener, in dependence on the information about positions of the loudspeakers and taking into consideration an information about one or more acoustic obstacles;

wherein the audio signal processor is configured to render the objects and/or the channel objects and/or the adapted signals derived from the input signals, in dependence on the information about the position of the listener and in dependence on the information about positions of the loudspeakers, in order to obtain the loudspeaker signals such that a rendered sound follows the listener when the listener moves or turns; and

wherein the audio signal processor is configured to take into consideration an attenuation of the sound between the loudspeakers and the listener or an elongation of an acoustic path between the loudspeakers and the listener due to the properties of the acoustic obstacle.

38. A method for providing a plurality of loudspeaker signals on the basis of a plurality of input signals,

wherein the method comprises obtaining an information about a position of a listener;

wherein the method comprises obtaining an information about positions of a plurality of loudspeakers;

wherein one or more loudspeakers are selected for rendering the objects and/or the channel objects and/or the adapted signals derived from the input signals, in dependence on the information about the position of the listener, in dependence on the information about positions of the loudspeakers and taking into consideration an information about one or more acoustic obstacles;

wherein the objects and/or the channel objects and/or the adapted signals derived from the input signals are rendered, in dependence on the information about the position of the listener and in dependence on the information about positions of the loudspeakers, in order to obtain the loudspeaker signals such that the rendered sound follows the listener when the listener moves or turns; and

wherein the objects and/or channel objects and/or adapted signals derived from the input signals are rendered with defined follow times, so that changes do not happen immediately, but the translational or rotational changes, or a combination of both, are adapted within adjustable time constants to the new listener position, such that, the sound image follows the listener in a way that the rendering is adapted smoothly over time.

39. A method for providing a plurality of loudspeaker signals on the basis of a plurality of input signals,

wherein the method comprises obtaining an information about a position of a listener;

wherein the method comprises obtaining an information about positions of a plurality of loudspeakers;

wherein one or more loudspeakers are selected for rendering the objects and/or the channel objects and/or the adapted signals derived from the input signals, in dependence on the information about the position of the listener, in dependence on the information about positions of the loudspeakers and taking into consideration an information about one or more acoustic obstacles;

wherein the objects and/or the channel objects and/or the adapted signals derived from the input signals are rendered, in dependence on the information about the position of the listener and in dependence on the information about positions of the loudspeakers, in order to obtain the loudspeaker signals such that the rendered sound follows the listener when the listener moves or turns; and

wherein an effective distance is calculated by correcting the distance between the listener and the loudspeakers by an acoustic attenuation or an acoustical transmission coefficient of the acoustic obstacles between the listener and the loudspeakers.

40. A method for providing a plurality of loudspeaker signals on the basis of a plurality of input signals,

wherein the method comprises obtaining an information about a position of a listener;

wherein the method comprises obtaining an information about positions of a plurality of loudspeakers;

wherein one or more loudspeakers are selected for rendering the objects and/or the channel objects and/or the adapted signals derived from the input signals, in dependence on the information about the position of the listener, in dependence on the information

about positions of the loudspeakers and taking into consideration an information about one or more acoustic obstacles;

wherein the objects and/or the channel objects and/or the adapted signals derived from the input signals are rendered, in dependence on the information about the position of the listener and in dependence on the information about positions of the loudspeakers, in order to obtain the loudspeaker signals such that the rendered sound follows the listener when the listener moves or turns; and

wherein the method comprises considering an attenuation of the sound between the loudspeakers and the listener or an elongation of an acoustic path between the loudspeakers and the listener due to the properties of the acoustic obstacle.

41. Computer program with a program code for performing the methods according to claim 38 or 39 or 40, when the computer program runs on a computer.