Claims

1. Sound processing apparatus, comprising:

a panner for spatial positioning of a plurality of input signals and combining the input signals into at least two spatial signals;

a dispersion filter stage for receiving the spatial signals and for dispersion filtering the spatial signals to obtain a set of filtered spatial signals;

an interface for providing a number of output signals, based on the filtered spatial signals.

2. The sound processing apparatus of claim 1, wherein the input signals comprise an early reflection signal and/or a diffracted sound signal of an audio scene.

3. The sound processing apparatus of claim 1 or 2, wherein a number of dispersion filters contained in the dispersion filter stage corresponds to the number of output signals.

4. The sound processing apparatus of one of previous claims, wherein the dispersion filter stage comprises at least one dispersion filter being an allpass filter.

5. The sound processing apparatus of one of previous claims, wherein the dispersion filter stage comprises at least one dispersion filter being an Finite Impulse Response, FIR, filter or an Infinite Impulse Response, IIR, filter.

6. The sound processing apparatus of one of previous claims, wherein at least one dispersion filter of the dispersion filter stage comprises a time-variant filter characteristic.

7. The sound processing apparatus of one of previous claims, comprising a renderer for providing the plurality of input signals.

8. The sound processing apparatus of claim 7, wherein the sound processing apparatus is configured for providing a direct sound component and a reverberated sound component.

9. The sound processing apparatus of claim 8, wherein the dispersion filter stage is configured for filtering the set of spatial signals; wherein the sound processing apparatus is configured for excluding the direct sound component and the reverberated sound component from the dispersion filter stage.

10. The sound processing apparatus of one of previous claims, comprising a dispersion filter generator configured for generating, e.g., during an initialization phase, at least one dispersion filter of the dispersion filter stage.

11. The sound processing apparatus of claim 10, wherein the dispersion filter generator is configured for generating the at least one dispersion filter based on:

- a length determining an amount of temporal spread provided by the dispersion filter;
- a spatial spread, e.g., by a high-level control to change a degree of Inter-channel Cross Correlation; and/or
- a gain.

12. The sound processing apparatus of claim 10 or 11, wherein the dispersion filter generator is configured for generating the dispersion filter as a first dispersion filterfor a first spatial signal; wherein the sound processing apparatus comprises a memory having stored thereon a set of stored noise signals of a same energy within a tolerance range and with different degrees of correlation with respect to each other;

wherein the sound processing apparatus is configured for selecting from the stored noise signals as a basis for the noise sequences.

13. The sound processing apparatus of claim 12, being configured for obtaining the noise signals based on at least one of:

- a characteristic that the noise signals are identical or weakly decorrelated sequences;
- a parameter, e.g., received as a bitstream parameter in a bitstream, indicating a length of the sequences;

- a parameter, e.g., received as a bitstream parameter in a bitstream, indicating a decorrelation or a spatial spread strength; and
- a parameter, e.g. received as a bitstream parameter in a bitstream, related to Interaural Cross Correlation, IACC, of a sound source with a small frontal aperture.

14. The sound processing apparatus of claim 12 or 13, wherein the dispersion filter generator is configured for generating the first dispersion filterand a second dispersion filterwith a frequency dependent filter decorrelation, e.g., obtained based on Interaural Cross Correlation, IACC.

15. The sound processing apparatus of one of claims 12 to 14, wherein the first noise sequence and the second noise sequence comprise an equal energy level.

16. The sound processing apparatus of previous claims, wherein a dispersion filter of the dispersion filter stage is based on a windowed noise sequence.

17. The sound processing apparatus of claim 16, wherein the windowed noise sequence is based on or corresponds to a white noise sequence.

18. The sound processing apparatus of one of previous claims, wherein a dispersion filter of the dispersion filter stage is a first dispersion filter for a first spatial signaland a second dispersion filter is for filtering a different second spatial signal;

wherein a first dispersion filter and a second dispersion filter are based on an identical windowed noise sequence; or

wherein the first dispersion filter and the second dispersion filter are based on different noise sequences that have a predefined correlation according to perceptual criteria.

19. The sound processing apparatus of one of previous claims, being energy-preserving and being adjustable in view of a filter gain.

20. The sound processing apparatus of one of previous claims, being configured for applying dispersion filter processing with the dispersion filter stage only to binauralized input signals.

21. The sound processing apparatus of one of previous claims, wherein the dispersion filter stage comprises at least a first dispersion filter for filtering a first spatial signal; and a second dispersion filter for filtering a second spatial signal; wherein the first dispersion filter and the second dispersion filter comprise a frequency dependent filter decorrelation, e.g., obtained based on Interaural Cross Correlation, IACC.

22. The sound processing apparatus of one of previous claims, wherein the panner comprises:

a plurality of binauralization stages; wherein each binauralization stage is for receiving one of the input signals and for binauralizing the received input signal for obtaining a first binauralized channel and a second binauralized channel;

a combiner for providing a first combination of the first binauralized channels of the binauralization stages; wherein a first spatial signal is based on the first combination; and for providing a second combination of the second binauralized channels of the binauralization stages; wherein a second spatial signal is based on the second combination.

23. The sound processing apparatus of one of claims 1 to 21, wherein the panner comprises a virtual loudspeaker processor for receiving and processing the input signals to obtain intermediate spatial signals;

a plurality of binauralization stages; wherein each binauralization stage is for receiving one of the intermediate spatial signals and for binauralizing the received intermediate spatial signal for obtaining a first binauralized channel and a second binauralized channel;

a combiner for providing a first combination of the first binauralized channels of the binauralization stages; wherein a first spatial signal is based on the first combination; and for providing a second combination of the second binauralized channels of the

binauralization stages; wherein a second spatial signal is based on the second combination.

24. The sound processing apparatus of claim 22 or 23, wherein the binauralization stages are configured according to a head related transfer function, HRTF.

25. The sound processing apparatus of one of claims 22 to 24, being configured for providing exactly two audio channels for the output signals.

26. The sound processing apparatus of one of claims 1 to 21, wherein the panner is configured for

receiving the input signals comprising at least one early reflection signal and/or at least one diffracted sound signal; and

receiving a direct sound component and a reverberated sound component associated to the input signals; and

wherein the spatial signals are each associated with a loudspeaker of a loudspeaker setup.

27. The sound processing apparatus of one of previous claims, wherein the output signals are associated each with an audio channel, e.g., L/R; wherein the sound processing apparatus comprises a direct sound processor for processing a direct sound component associated with the plurality of input signals;

wherein the panner further comprises a direct sound binauralization stage for receiving and binauralizing the direct sound component to obtain components each related to one of the audio channels;

wherein the sound processing apparatus comprises a combiner for combining signals related to a same audio channel to obtain a first audio signal and a second audio signal.

28. The sound processing apparatus of one of previous claims, wherein the output signals are associated each with an audio channel, e.g., L/R; wherein the sound processing

apparatus comprises a reverberation processor for processing a late reverberation component associated with the plurality of input signals;

wherein the panner further comprises a reverberation binauralization stage for receiving and binauralizing the late reverberation component to obtain components each related to one of the audio channels;

wherein the sound processing apparatus comprises a combiner for combining signals related to a same audio channel to obtain a first audio signal and a second audio signal.

29. The sound processing apparatus of one of previous claims, configured for filtering all input signals by use of exactly two dispersion filters of the dispersion filter stage for filtering the spatial signals obtained from all input signals.

30. The sound processing apparatus of claim 29, wherein the number of exactly two dispersion filters is independent from a number of input signals and/or independent from a number of sound sources providing the plurality of input signals.

31. The sound processing apparatus of one of previous claims, wherein the sound processing apparatus is configured for receiving the input signals or a basis thereof as a part of a bitstream and for using and/or configuring the dispersion filter stage based on one or more data fields of the bitstream, the one or more data fields comprising an indication of a use and/or configuration of the dispersion filter stage.

32. A decoder for decoding a bitstream comprising information representing an audio signal; the decoder comprising:

a sound processing apparatus of one of previous claims.

33. An encoder for encoding an audio signal into a bitstream, the encoder configured for generating the bitstream so as to comprise one or more of:

- information, e.g., a boolean flag, that allows to enable or disable a dispersion filter processing;

- information, e.g., a boolean flag, that enables or disables the dispersion filter processing for early reflections sounds;
- information, e.g., a boolean flag, that enables or disable the dispersion filter processing for diffracted sounds
- information indicating a parameter to signal the duration of the dispersion filter used for the dispersion filter processing e.g. in ms, as example between 0 ms and 100 ms
- information indicating a parameter to signal the dispersion filter gain
- information indicating a parameter to signal the spatial spread of the dispersion filter, e.g., between 0 degree and ±180 degrees

34. A bitstream comprising:

information indicating at least one spatial positioned input signal of an audio scene; and

one or more data fields comprising information that comprises an indication of a use and/or configuration of a dispersion filter for generating audio signals from the bitstream.

35. The bitstream of claim 34, wherein the information in the one or more data fields indicates at least one of:

- information, e.g., a boolean flag, that allows to enable or disable a dispersion filter processing;
- information, e.g., a boolean flag, that enables or disables the dispersion filter processing for early reflections sounds;
- information, e.g., a boolean flag, that enables or disable the dispersion filter processing for diffracted sounds
- information indicating a parameter to signal the duration of the dispersion filter used for the dispersion filter processing e.g. in ms, as example between 0 ms and 100 ms
- information indicating a parameter to signal the dispersion filter gain
- information indicating a parameter to signal the spatial spread of the dispersion filter, e.g., between 0 degree and ±180 degrees

36. Method for sound processing, the method comprising:

spatial positioning of a plurality of input signals and combining them into at least two spatial signals;

dispersion filtering the spatial signals to obtain a set of filtered spatial signals; and

providing a number of output signals, based on the filtered spatial signals.

37. Method for encoding an audio scene, the method comprising:

generating, from the audio scene, information indicating at least one spatial positioned input signal of the audio scene; and

providing one or more data fields comprising information that comprises an indication of a use and/or configuration of the dispersion filter for generating audio signals from the encoded audio scene.

38. A computer program for implementing the method of claim 36 or 37 when being executed on a computer or signal processor.