CLAIMS

1. An audio providing method performed by an audio apparatus, the audio providing method comprising:

receiving an audio signal including a plurality of channels;

generating a plurality of virtual audio signals, to be respectively output to a plurality of speakers, by applying an audio signal having a channel, from among the plurality of channels, giving a sense of elevation to a filter, the filter processing the audio signal to have a sense of elevation;

applying a combination gain value and a delay value to the plurality of virtual audio signals so that the plurality of virtual audio signals, which are respectively output through the plurality of speakers, form a sound field having a plane wave; and

respectively outputting the plurality of virtual audio signals, to which the combination gain value and the delay value are applied, through the plurality of speakers.

2. The audio providing method of claim 1, wherein the generating comprises:

copying the filtered audio signal to correspond to number of the speakers; and

applying a panning gain value, corresponding to each of the plurality of speakers, to each of a plurality of audio signals obtained through the copying so that the filtered audio signal has a virtual sense of elevation, to generate the plurality of virtual audio signals.

3. The audio providing method of claim 2, wherein the applying comprises:

multiplying a virtual audio signal corresponding to at least two speakers, from among the plurality of speakers, used to implement the sound field having the plane wave by the combination gain value; and

applying the delay value to the virtual audio signal corresponding to the at least two speakers.

4. The audio providing method of claim 3, wherein the applying comprises applying a gain value of 0 to an audio signal corresponding to a speaker except the at least two speakers from among the plurality of speakers.

5. The audio providing method of claim 1, wherein the applying comprises:

applying the delay value to the plurality of virtual audio signals respectively corresponding to the plurality of speakers; and

multiplying the plurality of virtual audio signals, to which the delay value is applied, by a final gain value obtained by multiplying the panning gain value and the combination gain value.

6. The audio providing method of claim 1, wherein the filter that processes the audio signal to have a sense of elevation is a head related transfer filter (HRTF).

7. The audio providing method of claim 1, wherein the respectively outputting comprises mixing a virtual audio signal, corresponding to a specific channel, with an audio signal having the specific channel to output an audio signal, obtained through the mixing, through a speaker corresponding to the specific channel.

8. An audio apparatus comprising:

an input unit configured to receive an audio signal including a plurality of channels;

a virtual audio generation unit configured to apply an audio signal, having a channel, from among the plurality of channels, giving a sense of elevation to a filter to generate a plurality of virtual audio signals to be respectively output to a plurality of speakers, the filter being configured to process the audio signal to have a sense of elevation;

a virtual audio processing unit configured to apply a combination gain value and a delay value to the plurality of virtual audio signals so the plurality of virtual audio signals respectively output through the plurality of speakers form a sound field having a plane wave; and

an output unit configured to respectively output the plurality of virtual audio signals, to which the combination gain value and the delay value are applied, through the plurality of speakers.

9. The audio apparatus of claim 8, wherein the virtual audio processing unit is further configured to copy the filtered audio signal to correspond to number of the speakers and apply a panning gain value, corresponding to each of the plurality of speakers, to each of a plurality of audio signals obtained through copying so that the filtered audio signal has a virtual sense of elevation, to generate the plurality of virtual audio signals.

10. The audio apparatus of claim 9, wherein the virtual audio processing unit is further configured to multiply a virtual audio signal, corresponding to at least two speakers, from among the plurality of speakers, for implementing the sound field having the plane wave, by the combination gain value and apply the delay value to the virtual audio signal corresponding to the at least two speakers.

11. The audio apparatus of claim 10, wherein the virtual audio processing unit is further configured to apply a gain value of 0 to an audio signal corresponding to a speaker except the at least two speakers from among the plurality of speakers.

12. The audio apparatus of claim 8, wherein the virtual audio processing unit is further configured to apply the delay value to the plurality of virtual audio signals respectively corresponding to the plurality of speakers and multiply the plurality of virtual audio signals, to which the delay value is applied, by a final gain value obtained by multiplying the panning gain value and the combination gain value.

13. The audio apparatus of claim 8, wherein the filter configured to process the audio signal to have a sense of elevation is a head related transfer filter (HRTF).

14. The audio apparatus of claim 8, wherein the output unit is further configured to mix a virtual audio signal, corresponding to a specific channel, with an audio signal having the specific channel to output an audio signal, obtained through the mixing, through a speaker corresponding to the specific channel.

15. An audio providing method performed by an audio apparatus, the audio providing method comprising:

receiving an audio signal including a plurality of channels;

applying an audio signal having a channel, from among the plurality of channels, giving a sense of elevation, to a filter that processes the audio signal to have a sense of elevation;

generating a plurality of virtual audio signals by applying different gain values to the audio signal according to a frequency, based on a kind of a channel of an audio signal from which a virtual audio signal is to be generated; and

respectively outputting the plurality of virtual audio signals through the plurality of speakers.

Claims

1. A method of rendering an audio signal, the method comprising:

receiving a multichannel signal to be converted from a plurality of input channels to a plurality of output channels;

obtaining filter coefficients for at least one height input channel, based on a Head-Related Transfer Function;

obtaining panning gains for the at least one height input channel, wherein the panning gains depend on a frequency range and a position of the at least one height input channel; and

performing elevation rendering on the at least one height input channel, based on the filter coefficients and the panning gains, to provide elevated sound images by the plurality of output channels.

2. The method of claim 1, the obtaining panning gains further comprising:

modifying paining gains for each of the plurality of output channels based on whether the each of the plurality of output channels is ipsilateral channel or contralateral channel.

3. The method of claim 1,

wherein the plurality of output channels are horizontal channels.

4. The method of claim 1, the method further comprising:

determining type of the elevation rendering; and

wherein the elevation rendering is performed further based on the determined type of the elevation rendering.

5. The method of claim 4,

wherein the type of the elevation rendering includes at least one of timbral rendering and spatial rendering.

6. The method of claim 4,

wherein the type of the elevation rendering is determined based on information included in audio bitstream of the audio signal.

7. The method of claim 1,

wherein each of the at least one height input channel is distributed to at least one of the plurality of output channels.

8. An apparatus of rendering an audio signal, the apparatus comprising:

a receiving unit configured to receive a multichannel signal to be converted from a plurality of input channels to a plurality of output channels;

an obtaining unit configured to obtain filter coefficients for at least one height input channel, based on a Head-Related Transfer Function and obtain panning gains for the at least one height input channel, wherein the panning gains depend on a frequency range and a position of the at least one height input channel; and

a rendering unit configured to perform elevation rendering on the at least one height input channel, based on the filter coefficients and the panning gains, to provide elevated sound images by the plurality of output channels.