the corrected head-related transfer function.

[0004]

Here, conventionally, when a three-dimensional sound for which an HRTF is used is reproduced using headphones, a head-related impulse response (HRIR) that is a representation of an HRTF on a time axis has been often used in computing an actual sound signal.

[Citation List]

[Patent Literature]

[0005]

[PTL 1] Japanese Unexamined Patent Application Publication No. 2021-5822

[Summary of Invention]

[Technical Problem]

[0006]

In the conventional sound processing device as stated in PTL 1, an HRIR is convolved for each sound source, and thus if the number of sound sources is high, it is necessary to convolve an HRIR for each of the sound sources, which results in an increase in the computation load.

[0007]

The present disclosure has been conceived in light of such circumstances, and is to address the above problem.

[Solution to Problem]

[0008]

According to a first aspect of the present disclosure, there is provided a sound generation device including: a direction obtainer that obtains a sound-source direction of a sound source; and a panner that expresses the sound source, by applying a time shift and gain adjustment to the sound source to perform panning for distributing a signal of the sound source to a plurality of representative directions, based on the sound-source direction obtained by the direction obtainer.

[0008a]

According to a second aspect of the present disclosure, there is provided a sound reproduction device including: the above sound generation device; and a sound outputter that outputs a sound signal generated by the sound generation device.

[0008b]

According to a third aspect of the present disclosure, there is provided a sound generation method executed by a sound generation device, the sound generation method including: obtaining a sound-source direction of a sound source; and expressing the sound source, by applying a time shift and gain adjustment to the sound source to perform panning for distributing a signal of the sound source to a plurality of representative directions, based on the sound-source direction obtained.

[0008c]

According to a fourth aspect of the present disclosure, there is provided a sound signal processing program executed by a sound generation device, the sound signal processing program causing the sound generation device to: obtain a sound-source direction of a sound source; and express the sound source, by applying a time shift and gain adjustment to the sound source to perform panning for distributing a signal of the sound source to a plurality of representative directions, based on the sound-source direction obtained.

[Advantageous Effects of Invention]

[0009]

Embodiments of the present disclosure can provide a sound generation device that can generate a stereophonic sound of an HRIR while the computation load is reduced, since a sound source is synthesized by panning in a particular representative direction, based on a direction of the sound source, to equivalently generate an HRIR in (for) the sound-source direction by using an HRIR in the representative direction.

[Brief Description of Drawings]
[0010]
[FIG. 1]
FIG. 1 illustrates a control configuration of a sound reproduction device according to Embodiment 1.
[FIG. 2]
FIG. 2 is a conceptual diagram illustrating concept of synthesis of head-related impulse responses (HRIRs) by panning illustrated in FIG. 1.
[FIG. 3]
FIG. 3 is a flowchart illustrating sound reproduction processing according to Embodiment 1.
[FIG. 4]
FIG. 4 is a diagram for explaining synthesis of HRIRs in the sound reproduction processing according to Embodiment 1.
[FIG. 5]
FIG. 5 illustrates a control configuration of another sound reproduction device according to Embodiment 1.
[FIG. 6]
FIG. 6 is a graph illustrating results of comparing signal-noise ratios (SNRs) using head-related transfer functions (HRTFs) (four directions_oblique, right ear) of a person himself/herself according to Embodiment 1.
[FIG. 7]
FIG. 7 is a graph illustrating results of comparing SNRs using HRTFs (four directions_oblique, left ear) of a person himself/herself according to Embodiment 1.
[FIG. 8]
FIG. 8 is a graph illustrating results of comparing SNRs using