CLAIMS

[Claim 1]

A sound reproduction system for reproducing sound in a listening space in which a listener is present, comprising:

a plurality of speakers disposed in the listening space; and

a controller configured to cause the plurality of speakers to reproduce two channels of sound including a left channel and a right channel, based on a left recording signal corresponding to a left ear of the listener and a right recording signal corresponding to a right ear of the listener;

wherein the plurality of speakers comprises a plurality of left speakers corresponding to the left channel and a plurality of right speakers corresponding to the right channel, and a discretized frequency bandwidth is preset for each of the plurality of left speakers and for each of the plurality of right speakers such that their respective output frequency bandwidths differ;

the controller configured to apply an approximate inverse matrix, which approximates an inverse of a plant matrix representing transfer paths from the plurality of speakers to both ears of the listener, to the left recording signal and the right recording signal, thereby causing the plurality of speakers to reproduce sound;

the sound output from the plurality of speakers comprises direct components being sound output from the plurality of left speakers to the listener’s left ear and from the plurality of right speakers to the listener’s right ear and cross components being sound output from the plurality of left speakers to the listener’s right ear and from the plurality of right

speakers to the listener’s left ear;

the approximate inverse matrix is expressed as a product of a gain correction term that corrects the signal intensity of the direct components in a frequency-dependent manner, a coefficient correction term that corrects, in a frequency-dependent manner, the intensity difference between the direct components and the cross components, a phase inversion term that inverts the phase of the cross components, and a delay correction term that applies a frequency-dependent time delay to the cross components; and

the controller comprises a plurality of circuits implementing the gain correction term, the coefficient correction term, the phase inversion term, and the delay correction term.

[Claim 2]

The sound reproduction system according to claim 1, wherein the controller comprises an amplification circuit implementing the gain correction term and the coefficient correction term, and a delay circuit implementing the phase inversion term and the delay correction term; and the delay circuit provides, uniformly within each discretized frequency band, a sum of: a time difference such that a phase difference between the direct components and the cross components is 180 degrees at a center frequency of the frequency bandwidth; and an arrival time difference between the direct components and the cross components.

[Claim 3]

The sound reproduction system according to claim 1, wherein the controller comprises an amplification circuit implementing the gain correction term and the coefficient correction term, an inversion circuit

implementing the phase inversion term, and a delay circuit implementing the delay correction term;

the inversion circuit inverts the signal polarity; and

the delay circuit provides, uniformly within each discretized frequency band, an arrival time difference between the direct components and the cross components.

[Claim 4]

The sound reproduction system according to claim 1, wherein the controller comprises a feedback circuit implementing the gain correction term, an amplification circuit implementing the coefficient correction term, and a delay circuit implementing the phase inversion term and the delay correction term;

the feedback circuit calculates the gain correction term as a function of frequency; and

the delay circuit provides, uniformly within each discretized frequency band, a sum of: a time difference such that a phase difference between the direct components and the cross components is 180 degrees at a center frequency of the frequency bandwidth; and an arrival time difference between the direct components and the cross components.

[Claim 5]

The sound reproduction system according to claim 1, wherein the controller comprises a feedback circuit implementing the gain correction term, an amplification circuit implementing the coefficient correction term, an inversion circuit implementing the phase inversion term, and a delay circuit implementing the delay correction term;

the feedback circuit calculates the gain correction term as a

function of frequency;

the inversion circuit inverts the signal polarity; and

the delay circuit provides, uniformly within each discretized frequency band, an arrival time difference between the direct components and the cross components.

[Claim 6]

The sound reproduction system according to any one of claims 2 to 5, wherein the arrival time difference is a time difference at which a correlation between an impulse response of the direct components and an impulse response of the cross components is maximized.

[Claim 7]

The sound reproduction system according to claim 2 or 3, wherein the gain correction term is a value within a range from 0.1 to 10.

[Claim 8]

The sound reproduction system according to claim 2 or 3, wherein the gain correction term is $\gamma/(1+g_i^2)$, where γ is a value within a range from 0.1 to 10, and g_i is a transfer gain ratio representing a ratio of signal intensities resulting from a path difference between the direct components and the cross components of a speaker in an i-th frequency band.

[Claim 9]

The sound reproduction system according to claim 8, wherein the transfer gain ratio is a ratio of a square root of a time-averaged integral of squared values of an impulse response of the direct components to a square root of a time-averaged integral of squared values of an impulse response of the cross components.

[Claim 10]

The sound reproduction system according to claim 8, wherein the transfer gain ratio is a ratio of a maximum absolute value of an impulse response of the direct components to a maximum absolute value of an impulse response of the cross components.

[Claim 11]

The sound reproduction system according to claim 4 or 5, wherein the gain correction term and the coefficient correction term are associated with a transfer gain ratio g_i, which is a ratio of signal intensities resulting from a path difference between the direct components and the cross components of a speaker in an i-th frequency band.

[Claim 12]

The sound reproduction system according to claim 11, wherein the transfer gain ratio is a ratio of a square root of a time-averaged integral of squared values of an impulse response of the direct components to a square root of a time-averaged integral of squared values of an impulse response of the cross components.

[Claim 13]

The sound reproduction system according to claim 11, wherein the transfer gain ratio is a ratio of a maximum absolute value of an impulse response of the direct components to a maximum absolute value of an impulse response of the cross components.