Claims

1. An audio decoder ~~(100;200;300)~~ for providing a decoded audio information ~~(112;212;312)~~ on the basis of an encoded audio information ~~(110;210;310)~~, the audio decoder comprising:

a linear-prediction-domain decoder ~~(120;220;320)~~ configured to provide a first decoded audio information ~~(122;222;322; $S_C(n)$)~~ on the basis of an audio frame encoded in a linear prediction domain;

a frequency domain decoder ~~(130;230;330)~~ configured to provide a second decoded audio information ~~(132;232;332; $S_M(n)$)~~ on the basis of an audio frame encoded in a frequency domain; and

a transition processor ~~(140;240;340)~~,

wherein the transition processor is configured to obtain a zero-input-response ~~(150; 256;348)~~ of a linear predictive filtering ~~(148; 254; 346)~~, wherein an initial state ~~(146;252;344)~~ of the linear predictive filtering is defined in dependence on the first decoded audio information and the second decoded audio information, and

wherein the transition processor is configured to modify the second decoded audio information ~~(132; 232;332;$S_M(n)$)~~, which is provided on the basis of an audio frame encoded in the frequency domain following an audio frame encoded in the linear prediction domain, in dependence on the zero-input-response, to obtain a smooth transition between the first decoded audio information ~~($S_C(n)$)~~ and the modified second decoded audio information ~~($\widehat{S_M}(n)$)~~.

2. The audio decoder according to claim 1,

wherein the transition processor is configured to obtain a first zero-input-response ~~(248; $s_Z^1(n)$)~~ of a linear predictive filter ~~(246)~~ in response to a first initial state ~~(244; $S_C(n)$)~~ of the linear predictive filter defined by the first decoded audio information ~~(222; $S_C(n)$)~~, and

wherein the transition processor is configured to obtain a second zero-input-response ~~(256; $s_Z^2(n)$)~~ of the linear predictive filter ~~(254)~~ in response to a second initial state ~~(252)~~ of the linear predictive filter defined by a modified version ~~($\widehat{S_C}(n)$)~~ of the first decoded audio information ~~(222, $S_C(n)$)~~, which is provided with an artificial aliasing, and which comprises a contribution of a portion of the second decoded audio information ~~(232, $S_M(n)$)~~, or

wherein the transition processor is configured to obtain a combined zero-input-response ~~(150; 348)~~ of the linear predictive filter ~~(148;346)~~ in response to an initial state ~~(146;344)~~ of the linear predictive filter defined by a combination of the first decoded audio information ~~(122;322; $S_C(n)$)~~ and of a modified version ~~($\widehat{S_C}(n)$)~~ of the first decoded audio information ~~(122;322; $S_C(n)$)~~, which is provided with an artificial aliasing, and which comprises a contribution of a portion of the second decoded audio information ~~(132;332;$S_M(n)$)~~;

wherein the transition processor is configured to modify the second decoded audio information ~~(132;232;332;$S_M(n)$)~~, which is provided on the basis of an audio frame encoded in the frequency domain following an audio frame encoded in the linear prediction domain, in dependence on the first zero-input-response ~~(248;$s_Z^1(n)$)~~ and the second zero-input-response ~~(256; $s_Z^2(n)$)~~, or in dependence on the combined zero-input-response ~~(150; $s_Z^1(n) - s_Z^2(n)$)~~, to obtain a smooth transition between the first decoded audio information ~~(122;222;322; $S_C(n)$)~~ and the modified second decoded audio information ~~(142;242;342;$\widehat{S_M}(n)$)~~.

3. The audio decoder ~~(100;200;300)~~ according to claim 1 or 2, wherein the frequency-domain decoder ~~(130;230;330)~~ is configured to perform an inverse lapped transform, such that the second decoded audio information ~~(132;232;332)~~ comprises an aliasing.

4. The audio decoder ~~(100;200;300)~~ according to claim 1 or claim 2 or claim 3, wherein the frequency-domain decoder ~~(130;230;330)~~ is configured to perform an inverse lapped transform, such that the second decoded audio information ~~(132;232;332)~~ comprises an aliasing in a time portion which is temporally overlapping with a time portion for which the linear-prediction-domain decoder ~~(120;220;320)~~ provides a first decoded audio information ~~(122;222;322)~~, and such that the second decoded audio information is aliasing-free for a time portion following the time portion for which the linear-prediction-domain decoder provides a first decoded audio information.

5. The audio decoder ~~(100;200;300)~~ according to one of claims 1 to 4, wherein the portion of the second decoded audio information ~~(132;232;332)~~, which is used to obtain the modified version ~~($\widehat{s_c}(n)$)~~ of the first decoded audio information, comprises an aliasing.

6. The audio decoder ~~(100;200;300)~~ according to claim 5, wherein the artificial aliasing, which is used to obtain the modified version ~~($\widehat{s_c}(n)$)~~ of the first decoded audio information, at least partially compensates an aliasing which is included in the portion of the second decoded audio information ~~(132;232;332)~~, which is used to obtain the modified version of the first decoded audio information.

7. The audio decoder ~~(100;200;300)~~ according to one of claims 1 to 6, wherein the transition processor ~~(140;240;340)~~ is configured to obtain the first zero-input-response ~~$s_z^1(n)$~~, or a first component ~~$s_z^1(n)$~~ of the combined zero-input-response, according to

$$s_Z^1(n) = -\sum_{m=1}^{M} a_m s_Z^1(n-m), n = 0, \dots, N-1$$

or according to

$$s_Z^1(n) = +\sum_{m=1}^{M} a_m s_Z^1(n-m), n = 0, \dots, N-1$$

with

$$s_Z^1(n) = S_C(n), n = -L, \dots, -1$$

$$M \leq L$$

wherein n designates a time index,

wherein $s_Z^1(n)$ for n=0,…,N-1 designates the first zero input response ~~(248)~~ for time index n, or a first component of the combined zero-input-response ~~(150;348)~~ for time index n;

wherein $s_Z^1(n)$ for n=-L,…,-1 designates the first initial state ~~(244)~~ for time index n, or a first component of the initial state ~~(146;344)~~ for time index n;

wherein m designates a running variable,

wherein M designates a filter length of the linear predictive filter;

wherein a_m designates filter coefficients of the linear predictive filter;

wherein $S_c(n)$ designates a previously decoded value of the first decoded audio information ~~(122;222;322)~~ for time index n;

wherein N designates a processing length.

8. The audio decoder ~~(100;200;300)~~ according to one of claims 1 to 7, wherein the transition processor ~~(140;240;340)~~ is configured to apply a first windowing ~~((w(-n-1)w(-n-1))~~ to the first decoded audio information ~~(122;222;322; $S_C(n)$)~~, to obtain a windowed version of the first decoded audio information, and to apply a second windowing ~~(w(n+L)w(-n-1))~~ to a time-mirrored version ~~($S_C(-n-L-1)$)~~ of the first decoded audio information ~~(122;222;322;$S_C(n)$)~~, to obtain a windowed version of the time-mirrored version of the first decoded audio information, and

wherein the transition processor is configured to combine the windowed version of the first decoded audio information and the windowed version of the time-mirrored version of the first decoded audio information, in order to obtain the modified version ~~($\widehat{S_C}(n)$)~~ of the first decoded audio information.

9. The audio decoder according to one of claims 1 to 8, wherein the transition processor ~~(140;240;340)~~ is configured to obtain the modified version ~~$\widehat{S_C}(n)$~~ of the first decoded audio information ~~$S_C(n)$~~ according to

$$\widehat{S_C}(n) = S_C(n)w(-n-1)w(-n-1) + S_C(-n-L-1)w(n+L)w(-n-1) + S_M(n),$$

$$n = -L, \dots, -1,$$

wherein n designates a time index,

wherein w(-n-1) designates a value of a window function for time index (-n-1);

wherein w(n+L) designates a value of a window function for time index (n+L);

wherein $S_c(n)$ designates a previously decoded value of the first decoded audio information ~~(122;222;322)~~ for time index (n);

wherein $S_c(-n-L-1)$ designates a previously decoded value of the first decoded audio information for time index (-n-L-1);

wherein $S_M(n)$ designates a decoded value of the second decoded audio information ~~(132;232;332)~~ for time index n; and

wherein L describes a length of a window.

10 The audio decoder ~~(100;200;300)~~ according to one of claims 1 to 9, wherein the transition processor ~~(140;240;340)~~ is configured to obtain the second zero-input-response ~~(256;$s_Z^2(n)$)~~, or a second component ~~$s_Z^2(n)$~~ of the combined zero-input-response ~~(150;348)~~ according to

$$s_Z^2(n) = -\sum_{m=1}^{M} a_m s_Z^2(n-m), n = 0, \dots, N-1$$

or according to

$$s_Z^2(n) = +\sum_{m=1}^{M} a_m s_Z^2(n-m), n = 0, \dots, N-1$$

with

$$s_Z^2(n) = \widehat{S_C}(n), n = -L, \dots, -1$$

$$M \leq L$$

wherein n designates a time index,

wherein $s_Z^2(n)$ for n=0,…,N-1 designates the second zero input response for time index n, or a second component of the combined zero-input-response for time index n;

wherein $s_Z^2(n)$ for n=-L,…,-1 designates the second initial state ~~(252)~~ for time index n, or a second component of the initial state ~~(146;344)~~ for time index n;

wherein m designates a running variable,

wherein M designates a filter length of the linear predictive filter~~(148;254;346)~~;

wherein a_m designates filter coefficients of the linear predictive filter;

wherein $\widehat{S_C}(n)$ designates values of the modified version of the first decoded audio information for time index n;

wherein N designates a processing length.

11. The audio decoder ~~(100;200;300)~~ according to one of claims 1 to 10, wherein the transition processor ~~(140;240;340)~~ is configured to linearly combine the second decoded audio information ~~(132;232;332)~~ with the first zero-input-response ~~(248)~~ and the second zero-input-response~~(256)~~, or with the combined zero-input-response ~~(150;348)~~, for a time portion for which no first decoded audio information ~~(122;222;322)~~ is provided by the linear-prediction-domain decoder ~~(120;220;320)~~ , in order to obtain the modified second decoded audio information.

12. The audio decoder ~~(100;200;300)~~ according to one of claims 1 to 11, wherein the transition processor ~~(140;240;340)~~ is configured to obtain the modified second decoded audio information ~~$\widehat{S_M}(n)$~~ according to

$$\widehat{S_M}(n) = S_M(n) - s_Z^2(n) + s_Z^1(n), \text{ for n=0,...,N-1,}$$

or according to

$$\widehat{S_M}(n) = S_M(n) - v(n)s_Z^2(n) + v(n)s_Z^1(n), \text{ for n=0,...,N-1,}$$

wherein

wherein n designates a time index;

wherein $S_M(n)$ designates values of the second decoded audio information for time index n;

wherein $s_Z^1(n)$ for n=0,…,N-1 designates the first zero input response for time index n, or a first component of the combined zero-input-response for time index n; and

wherein $s_Z^2(n)$ for n=0,…,N-1 designates the second zero input response for time index n, or a second component of the combined zero-input-response for time index n;

wherein v(n) designates values of a window function;

wherein N designates a processing length.

13. The audio decoder ~~(100;200;300)~~ according to one of claims 1 to 12, wherein the transition processor ~~(140;240;340)~~ is configured to leave the first decoded audio information ~~(122;222;322)~~ unchanged by the second decoded audio information ~~(132;232;332)~~ when providing a decoded audio information for an audio frame encoded in a linear-prediction domain, such that the decoded audio information provided for an audio frame encoded in the linear-prediction-domain is provided independent from decoded audio information provided for a subsequent audio frame encoded in the frequency domain.

14. The audio decoder ~~(100;200;300)~~ according to one of claims 1 to 13, wherein the audio decoder is configured to provide a fully decoded audio information ~~(122;222;322)~~ for an audio frame encoded in the linear-prediction domain, which is followed by an audio frame encoded in the frequency domain, before decoding the audio frame encoded in the frequency domain.

15. The audio decoder ~~(100;200;300)~~ according to one of claims 1 to 14, wherein the transition processor ~~(140;240;340)~~ is configured to window the first zero-input-response ~~(248)~~ and the second zero-input-response ~~(256)~~, or the combined zero-input-response ~~(150;348)~~, before modifying the second decoded audio information ~~(132;232;332)~~ in dependence on the windowed first zero-input-response and the windowed second zero-input-response, or in dependence on the windowed combined zero-input-response.

16. The audio decoder ~~(100;200;300)~~ according to claim 15, wherein the transition processor is configured to window the first zero-input-response and the second zero-input-response, or the combined zero-input-response, using a linear window.

17. A method ~~(900)~~ for providing a decoded audio information on the basis of an encoded audio information, the method comprising:

providing ~~(910)~~ a first decoded audio information ~~($S_C(n)$)~~ on the basis of an audio frame encoded in a linear prediction domain;

providing ~~(920)~~ a second decoded audio information ~~($S_M(n)$)~~ on the basis of an audio frame encoded in a frequency domain; and

obtaining ~~(930)~~ a zero-input-response of a linear predictive filtering, wherein an initial state of the linear predictive filtering is defined in dependence on the first decoded audio information and the second decoded audio information, and

modifying ~~(940)~~ the second decoded audio information ~~($S_M(n)$)~~, which is provided on the basis of an audio frame encoded in the frequency domain following an audio frame encoded in the linear prediction domain, in dependence on the zero-input-response, to obtain a smooth transition between the first decoded audio information ~~($S_C(n)$)~~ and the modified second decoded audio information ~~($\widehat{S_M}(n)$)~~.

18. A computer program for performing the method according to claim 17 when the computer program runs on a computer.