For instance, based on the aforementioned first and second measures, one of first and second loss concealment tools may be assigned to the lost portion with a first being configured to recover the audio signal by audio signal synthesis using a periodic signal of a periodicity which depends on a pitch value derived from the data stream, and the second loss concealment tool may be configured to recover the audio signal by detecting tonal spectral components of the audio signal, performing phase detection at the tonal spectral components and audio signal synthesis by combining the signals of periodicities which depend on the tonal spectral components at adjustment of a mutual phase shift between the signals depending on the phase detection. In other words, based on the first and second measures, one of a tonal frequency domain PLC tool and a tonal time domain PLC tool may be assigned to the lost portion.

In accordance with an embodiment, the assignment/selection for a lost portion is performed in stages: A third measure measuring a tonality of the spectrum of the audio signal is determined and one of a first and second subsets of one or more loss concealment tools out of the set of different loss concealment tools is assigned to the lost portion, and merely if the first subset of one or more loss concealment tools is assigned to the lost portion, the assignment of the one PLC tool for the lost portion is performed based on the first and second measures out of this first subset. Otherwise, the assignment/selection is performed out of the second subset.

According to an aspect of the present application, there is provided an audio decoder for decoding an audio signal from a data stream, the audio decoder comprising a set of different loss concealment tools and configured to determine a first measure measuring a spectral position of a spectral centroid of a spectrum of the audio signal, determine a second measure measuring a temporal predictability of the audio signal, assign one of the set of different loss concealment tools to a portion of the audio signal affected by loss based on the first and second measures, and recover the portion of the audio signal using the one loss concealment tool assigned to the portion, wherein the set of different loss concealment tools comprises: a first loss concealment tool for audio signal recovery of monophonic portions, and a second loss concealment tool for audio signal recovery of polyphonic portions, and wherein the audio decoder is configured to, in assigning the one of the set of different loss concealment tools to the portion of the audio signal based on the first and second measures, assign the first loss concealment tool to the portion the more likely the lower the spectral position of the spectral centroid is and the higher the temporal predictability is, and assign the second loss concealment tool to the portion the

more likely the higher the spectral position of the spectral centroid is and the lower the temporal predictability is.

According to another aspect of the present application, there is provided an audio decoder for decoding an audio signal from a data stream, the audio decoder comprising a set of different loss concealment tools and configured to: determine a first measure measuring a spectral position of a spectral centroid of a spectrum of the audio signal, determine a second measure measuring a temporal predictability of the audio signal, assign one of the set of different loss concealment tools to a portion of the audio signal affected by loss based on the first and second measures, and recover the portion of the audio signal using the one loss concealment tool assigned to the portion, wherein the audio decoder is configured to, in assigning one of the set of different loss concealment tools to a portion of the audio signal affected by loss based on the first and second measures, perform a summation over the first and second measures so as to obtain a scalar sum value and subjecting the scalar sum value to thresholding.

According to another aspect of the present application, there is provided a method for performing loss concealment in audio decoding an audio signal from a data stream, the method comprising: determining a first measure measuring a spectral position of a spectral centroid of a spectrum of the audio signal, determining a second measure measuring a temporal predictability of the audio signal, assigning one of a set of different loss concealment tools to a portion of the audio signal affected by loss based on the first and second measures, and recovering the portion of the audio signal using the one loss concealment tool assigned to the portion, wherein the set of different loss concealment tools comprises: a first loss concealment tool for audio signal recovery of monophonic portions, and a second loss concealment tool for audio signal recovery of polyphonic portions, and wherein the assigning the one of the set of different loss concealment tools to the portion of the audio signal based on the first and second measures comprises assigning the first loss concealment tool to the portion the more likely the lower the spectral position of the spectral centroid is and the higher the temporal predictability is, and assigning the second loss concealment tool to the portion the more likely the higher the spectral position of the spectral centroid is and the lower the temporal predictability is.

According to yet another aspect of the present application, there is provided a method for performing loss concealment in audio decoding an audio signal from a data stream, the method comprising:determining a first measure measuring a spectral position of a spectral

centroid of a spectrum of the audio signal, determining a second measure measuring a temporal predictability of the audio signal, assigning one of a set of different loss concealment tools to a portion of the audio signal affected by loss based on the first and second measures, and recovering the portion of the audio signal using the one loss concealment tool assigned to the portion, wherein the assigning one of the set of different loss concealment tools to a portion of the audio signal affected by loss based on the first and second measures comprises performing a summation over the first and second measures so as to obtain a scalar sum value and subjecting the scalar sum value to thresholding.

Advantageous aspects of the present application are the subject of dependent claims. Preferred embodiments of the present application are set out below with respect to the figures among which:

Fig. 1 shows in a schematic manner a block diagram of an audio decoder in accordance with an embodiment of the present application;

Fig. 2 shows a flow diagram of a mode of operation of the assigner 32 of the audio decoder of Fig. 1 in accordance with an embodiment;

Fig. 3 shows a schematic diagram illustrating a spectral centroid detection for determining the first measure for PLC assignment in Fig. 2 in accordance with an embodiment;

Claims

1. Audio decoder for decoding an audio signal from a data stream, the audio decoder comprising a set of different loss concealment tools and configured to

determine a first measure measuring a spectral position of a spectral centroid of a spectrum of the audio signal,

determine a second measure measuring a temporal predictability of the audio signal,

assign one of the set of different loss concealment tools to a portion of the audio signal affected by loss based on the first and second measures, and

recover the portion of the audio signal using the one loss concealment tool assigned to the portion,

wherein the set of different loss concealment tools comprises:

a first loss concealment tool for audio signal recovery of monophonic portions, and

a second loss concealment tool for audio signal recovery of polyphonic portions, and

wherein the audio decoder is configured to, in assigning the one of the set of different loss concealment tools to the portion of the audio signal based on the first and second measures, assign the first loss concealment tool to the portion the more likely the lower the spectral position of the spectral centroid is and the higher the temporal predictability is, and assign the second loss concealment tool to the portion the more likely the higher the spectral position of the spectral centroid is and the lower the temporal predictability is.

2. Audio decoder of claim 1, wherein

the first loss concealment tool is configured to recover the audio signal by audio signal synthesis using a periodic signal of a periodicity which depends on a pitch value derived from the data stream, and

the second loss concealment tool is configured to cover the audio signal by detecting tonal spectral components of the audio signal, performing phase detection at the tonal spectral components and audio signal synthesis by combining the signals of periodicities which depend on the tonal spectral components with adjusting a mutual phase shift between the signals depending on the phase detection, and

wherein the set of different loss concealment tools further comprises one or more of a third loss concealment tool for audio signal recovery by use of frame repetition, with or without replicate modification.

3. Audio decoder of claim 1 or 2, wherein

the first loss concealment tool for audio signal recovery uses tonal time domain packet loss concealment, and

the second loss concealment tool for audio signal recovery uses tonal frequency domain packet loss concealment.

4. Audio decoder of any one of the preceding claims, wherein

the first loss concealment tool for audio signal recovery is based on audio signal synthesis using a periodic signal of a periodicity which depends on a pitch value derived from the data stream, and

the second loss concealment tool for audio signal recovery is based on detecting tonal spectral components of the audio signal, performing phase detection at the tonal spectral components and audio signal synthesis by combining the signals of periodicities which depend on the tonal spectral components with adjusting a mutual phase shift between the signals depending on the phase detection.

5. Audio decoder of claim 4, wherein the audio decoder is configured to
derive the pitch value from the data stream by using a most recent pitch parameter conveyed in the data stream as the pitch value.

6. Audio decoder of claim 4 or 5, wherein the audio decoder is configured to

perform the detection of the tonal spectral components by identifying co-located peaks in one or more consecutive spectra derived from a most recent non-lost portion of the data stream.

7. Audio decoder of claim 6, wherein the data stream has the most recent non-lost portion of the data stream encoded thereinto in spectral domain.

8. Audio decoder of any one of the preceding claims, configured to

perform loss detection to detect portions affected by loss,

perform the determination of the first and second measures for the portion responsive to the loss detection detecting the portion affected by loss, and refrain from performing the determination for portions not affected by loss.

9. Audio decoder of any one of the preceding claims, further configured to

determine a tonality indicator indicative of a tonality of the audio signal,

assign one of first and second subsets of one or more loss concealment tools out of the set of different loss concealment tools, which are mutually disjoint, to the portion of the audio signal based on the tonality indicator, and

perform the assignment of the one of the set of different loss concealment tools to the portion of the audio signal based on the first and second measures by assigning the of the set of different loss concealment tools to the portion of the audio signal based on the first and second measures out of the first subset of one or more loss concealment tools if the first subset is assigned to the portion with performing the recovery of the portion of the audio signal using the one loss concealment tool assigned to the portion, and perform the recovery of the portion of the audio signal using one out of the second subset of the loss concealment tools if the second subset of the loss concealment tools is assigned to the portion.

10. Audio decoder of claim 9, wherein the audio decoder is configured to

use a parameter conveyed in the data stream as the third measure.

11. Audio decoder of claim 9 or 10, wherein the audio decoder is configured to

use a presence or non-presence of a pitch parameter in a most recent non-lost frame of the data stream as the third measure.

12. Audio decoder of any of claims 9 to 11, wherein

the first loss concealment tool is configured to recover the audio signal by audio signal synthesis using a periodic signal of a periodicity which depends on a pitch value derived from the data stream, and

the second loss concealment tool is configured to recover the audio signal by detecting tonal spectral components of the audio signal, performing phase detection at the tonal spectral components and audio signal synthesis by combining the signals of periodicities which depend on the tonal spectral components with adjusting a mutual phase shift between the signals depending on the phase detection, and

wherein the set of different loss concealment tools further comprises a third loss concealment tool for audio signal recovery by use of frame repetition, with or without replicate modification, and

wherein the third loss concealment tool is included in the second subset and the second and the first and second loss concealment tools are included in the first subset.

13. Audio decoder of any of the preceding claims, configured to determine the first measure by a weighted sum of spectral component location values, each weighted using the spectrum of the audio signal at the respective spectral component location value.

14. Audio decoder of any of the preceding claims, configured to determine the second measure by a correlation measure measuring a self-similarity of the audio signal.

15. Audio decoder of any of the preceding claims, configured to determine the second measure by deriving a pitch from the audio signal and determining the second measure as a correlation measure measuring an autocorrelation of the audio signal at a temporal shift which depends on the pitch.

16. Audio decoder for decoding an audio signal from a data stream, the audio decoder comprising a set of different loss concealment tools and configured to:

determine a first measure measuring a spectral position of a spectral centroid of a spectrum of the audio signal,

determine a second measure measuring a temporal predictability of the audio signal,

assign one of the set of different loss concealment tools to a portion of the audio signal affected by loss based on the first and second measures, and

recover the portion of the audio signal using the one loss concealment tool assigned to the portion,

wherein the audio decoder is configured to, in assigning one of the set of different loss concealment tools to a portion of the audio signal affected by loss based on the first and second measures, perform a summation over the first and second measures so as to obtain a scalar sum value and subjecting the scalar sum value to thresholding.

17. Audio decoder of any of the preceding claims, configured to determine the first measure by deriving the spectrum from scale factors in a most recent non-lost portion of the data stream.

18. Audio decoder of any of the preceding claims, configured to determine the first measure by deriving the spectrum from scale factors in a most recent non-lost portion of the data stream and subjecting the scale factors coded in the data stream to spectral interpolation.

19. Audio decoder of claim 17 or 18, configured to subject the scale factors to a de-emphasis filtering by multiplication with a de-emphasis filter's transfer function.

20. Method for performing loss concealment in audio decoding an audio signal from a data stream, the method comprising:

determining a first measure measuring a spectral position of a spectral centroid of a spectrum of the audio signal,

determining a second measure measuring a temporal predictability of the audio signal,

assigning one of a set of different loss concealment tools to a portion of the audio signal affected by loss based on the first and second measures, and

recovering the portion of the audio signal using the one loss concealment tool assigned to the portion,

wherein the set of different loss concealment tools comprises:

a first loss concealment tool for audio signal recovery of monophonic portions, and

a second loss concealment tool for audio signal recovery of polyphonic portions, and

wherein the assigning the one of the set of different loss concealment tools to the portion of the audio signal based on the first and second measures comprises assigning the first loss concealment tool to the portion the more likely the lower the spectral position of the spectral centroid is and the higher the temporal predictability is, and assigning the second loss concealment tool to the portion the more likely the higher the spectral position of the spectral centroid is and the lower the temporal predictability is.

21. Method for performing loss concealment in audio decoding an audio signal from a data stream, the method comprising:

determining a first measure measuring a spectral position of a spectral centroid of a spectrum of the audio signal,

determining a second measure measuring a temporal predictability of the audio signal,

assigning one of a set of different loss concealment tools to a portion of the audio signal affected by loss based on the first and second measures, and

recovering the portion of the audio signal using the one loss concealment tool assigned to the portion,

wherein the assigning one of the set of different loss concealment tools to a portion of the audio signal affected by loss based on the first and second measures comprises performing a summation over the first and second measures so as to obtain a scalar sum value and subjecting the scalar sum value to thresholding.

22. Computer program with a program code for executing, when running on a processor, a method according to claim 20 or 21.