Claims

1. A decoder for decoding a frame to reconstruct a signal portion of a signal, wherein the signal portion is encoded within the frame, wherein the frame comprises a bitstream payload and two or more redundancy bits, wherein the bitstream payload comprises a plurality of payload bits, wherein each of the payload bits exhibits a position within the bitstream payload, wherein the decoder comprises:

a channel decoding module, being configured to detect, depending on the two or more redundancy bits, whether the bitstream payload comprises one or more corrupted bits being one or more of the payload bits that are distorted or that are likely to be distorted, and

a source decoding module,

wherein, if the channel decoding module has not detected any corrupted bits within the bitstream payload, the source decoding module is configured to decode the bitstream payload without conducting error concealment to reconstruct the signal portion,

wherein, if the channel decoding module has detected the one or more corrupted bits within the bitstream payload, the source decoding module is configured to select a selected error concealment mode of two or more error concealment modes depending on the position of at least one of the one or more corrupted bits within the bitstream payload and depending on a signal characteristic of the signal portion of the signal, and is configured to conduct error concealment depending on the selected error concealment mode to reconstruct the signal portion.

2. A decoder according to claim 1,

wherein the channel decoding module is an error detection and error correction module being configured to conduct error correction on the bitstream payload before detecting whether the bitstream payload comprises the one or more corrupted bits.

3. A decoder according to claim 1 or 2,

wherein a first one of the two or more error concealment modes is a full frame loss concealment mode,

wherein, if the channel decoding module has indicated that the bitstream payload comprises the one or more corrupted bits, and if the selected error concealment mode is the full frame loss concealment mode, the source decoding module is configured to conduct error concealment without using the bitstream payload.

4. A decoder according to claim 3,

wherein a second one of the two or more error concealment modes is a partial frame loss concealment mode,

wherein, if the channel decoding module has indicated that the bitstream payload comprises the one or more corrupted bits, and if the selected error concealment mode is the partial frame loss concealment mode, the source decoding module is configured to obtain the decoded signal by decoding other bits of the payload bits that are not indicated by the channel decoding module to be the one or more corrupted bits without conducting error concealment on the other bits, and by conducting error concealment on the one or more of the payload bits that are indicated by the channel decoding module to be the one or more corrupted bits.

5. A decoder according to claim 4,

wherein the two or more error concealment modes comprise exactly two error concealment modes,

wherein a first one of the exactly two error concealment modes is the full frame loss concealment mode,

wherein a second one of the exactly two error concealment modes is the partial frame loss concealment mode.

6. A decoder according to claim 4 or 5,

wherein the bitstream payload is partitioned into a first part of the plurality of payload bits of the bitstream payload, and into a second part of the plurality of payload bits of the bitstream payload,

wherein, if the channel decoding module has indicated that the bitstream payload comprises the one or more corrupted bits, and if the first part of the bitstream payload comprises at least one of the one or more corrupted bits, the source decoding module is configured to select the full frame loss concealment mode as the selected error concealment mode, and

wherein, if the channel decoding module has indicated that the bitstream payload comprises the one or more corrupted bits, and if the first part of the bitstream payload does not comprise any of the one or more corrupted bits, the source decoding module is configured to select the selected error concealment mode depending on the signal characteristic of the signal portion of the signal.

7. A decoder according to claim 6,

wherein the frame is a current frame, wherein the bitstream payload is a current bitstream payload, wherein the plurality of payload bits is a plurality of current payload bits, wherein the signal portion of the signal is a current signal portion of the signal, and wherein the signal characteristic is a current signal characteristic,

wherein, if the channel decoding module has indicated that the current bitstream payload comprises the one or more corrupted bits, the source decoding module (120) is configured to select the selected error concealment mode of two or more error concealment modes depending on the current signal characteristic of the current signal portion of the signal being encoded by the plurality of current payload bits of the current frame, and depending on a previous signal characteristic of a previous signal portion of the signal being encoded by a plurality of previous payload bits of a previous bitstream payload of a previous frame.

8. A decoder according to claim 7, wherein the decoder is an audio decoder,

wherein the current signal portion of the signal being encoded by the plurality of current payload bits of the current bitstream payload is a current audio signal portion of an audio signal, and

wherein the previous signal portion of the signal being encoded by the plurality of previous payload bits of the previous bitstream payload is a previous audio signal portion of the audio signal

wherein the current bitstream payload encodes a plurality of spectral lines of the current audio signal portion.

9. A decoder according to claim 8,

wherein, if the channel decoding module has indicated that the current bitstream payload comprises the one or more corrupted bits, and if the first part of the current bitstream payload does not comprise any of the one or more corrupted bits, the source decoding module is configured to select the full frame loss concealment mode as the selected error concealment mode, if the previous frame was concealed using full frame loss concealment.

10. A decoder according to claim 8,

wherein, if the channel decoding module has indicated that the current bitstream payload comprises the one or more corrupted bits, and if the first part of the current bitstream payload does not comprise any of the one or more corrupted bits, the source decoding module is configured to select the full frame loss concealment mode as the selected error concealment mode, if a highest spectral line among the plurality of spectral lines of the current audio signal portion exhibits a frequency being smaller than or equal to a threshold frequency.

11. A decoder according to claim 8,

wherein, if the channel decoding module has indicated that the current bitstream payload comprises the one or more corrupted bits, and if the first part of the current bitstream payload does not comprise any of the one or more corrupted bits, the source decoding module is configured to select the full frame loss concealment mode as the selected error concealment mode, if a stability factor is smaller than a predefined threshold, wherein said stability factor indicates a stability of the current audio signal portion and of the previous audio signal portion.

12. A decoder) according to claim 8,

wherein, if the channel decoding module has indicated that the current bitstream payload comprises the one or more corrupted bits, and if the first part of the current bitstream payload does not comprise any of the one or more corrupted bits, the

source decoding module is configured to select the full frame loss concealment mode as the selected error concealment mode,

if the previous frame was concealed using full frame loss concealment, or

if a stability factor is smaller than a predefined threshold, wherein said stability factor indicates a stability of the current audio signal portion and of the previous audio signal portion.

13. A decoder according to claim 11 or 12,

wherein the predefined threshold is equal to 0.5.

14. A decoder according to one of claims 8 to 13,

wherein, if the channel decoding module has indicated that the current bitstream payload comprises the one or more corrupted bits, and if the first part of the current bitstream payload does not comprise any of the one or more corrupted bits, the source decoding module is configured to select the full frame loss concealment mode as the selected error concealment mode,

if the highest spectral line among the plurality of spectral lines of the current audio signal portion exhibits said frequency being smaller than or equal to said threshold frequency, and

if the first part of the current bitstream payload encodes a signal component which is tonal or harmonic, and

if the previous signal portion encodes at least one peak of the audio signal being greater than a peak threshold value and which corresponds to a frequency being greater than all frequencies being indicated by the plurality of spectral lines of the current audio signal portion.

15. A decoder according to claim 14,

wherein a pitch of the audio signal exhibits a pitch frequency, and

wherein, if the channel decoding module has indicated that the current bitstream payload comprises the one or more corrupted bits, and if the first part of the current bitstream payload does not comprise any of the one or more corrupted bits, the source decoding module is configured to select the full frame loss concealment mode as the selected error concealment mode,

if the highest spectral line among the plurality of spectral lines of the current audio signal portion exhibits said frequency being smaller than or equal to said threshold frequency, and

if the first part of the current bitstream payload encodes a signal component which is tonal or harmonic, and

if all frequencies being indicated by the plurality of spectral lines of the current audio signal portion are smaller than the pitch frequency; or

wherein, if the channel decoding module has indicated that the current bitstream payload comprises the one or more corrupted bits, and if the first part of the current bitstream payload does not comprise any of the one or more corrupted bits, the source decoding module is configured to select the full frame loss concealment mode as the selected error concealment mode,

if the highest spectral line among the plurality of spectral lines of the current audio signal portion exhibits said frequency being smaller than or equal to said threshold frequency, and

if the first part of the current bitstream payload encodes a signal component which is tonal or harmonic, and

if all frequencies being indicated by the plurality of spectral lines of the current audio signal portion are smaller than a maximal supported pitch frequency.

16. A decoder according to claim 15,

wherein, if the channel decoding module has indicated that the current bitstream payload comprises the one or more corrupted bits, and if the first part of the current bitstream payload does not comprise any of the one or more corrupted bits, the source decoding module is configured to select the full frame loss concealment

mode as the selected error concealment mode, if the highest spectral line among the plurality of spectral lines of the current audio signal portion exhibits said frequency being smaller than or equal to said threshold frequency, and if the first part of the current bitstream payload does not encode a signal component of the audio signal which is tonal or harmonic, and if the ratio between the energy from 0 to the frequency bin $k_{be} - 1$ of the previous quantized spectrum of the previous audio signal to the energy from 0 to the top of the previous quantized spectrum of the previous audio signal is smaller than a ratio threshold, wherein k_{be} is a first spectral bin which cannot be recovered.

17. A decoder according to claim 16, wherein the ratio threshold is 0.3.

18. A decoder according to claim 16 or 17,

wherein, if the channel decoding module has indicated that the current bitstream payload comprises the one or more corrupted bits, and if the first part of the current bitstream payload does not comprise any of the one or more corrupted bits, the source decoding module is configured to select the partial frame loss concealment mode as the selected error concealment mode,

if the previous frame was not concealed using full frame loss concealment, and

if the highest spectral line among the plurality of spectral lines of the current audio signal portion exhibits a frequency being greater than said threshold frequency.

19. A decoder according to claim 18,

wherein, if the channel decoding module has indicated that the current bitstream payload comprises the one or more corrupted bits, and if the first part of the current bitstream payload does not comprise any of the one or more corrupted bits, the source decoding module is configured to select the partial frame loss concealment mode as the selected error concealment mode,

if the previous frame was not concealed using full frame loss concealment, and

if the highest spectral line among the plurality of spectral lines of the current audio signal portion exhibits said frequency being greater than said threshold frequency, and

if said stability factor is greater than or equal to said predefined threshold, and

if the first part of the current bitstream payload does not encode a signal component of the audio signal which is tonal or harmonic, and if the ratio between the energy from 0 to the frequency bin $k_{be} - 1$ of the previous quantized spectrum of the previous audio signal to the energy from 0 to the top of the previous quantized spectrum of the previous audio signal is greater than or equal to said ratio threshold.

20. A decoder according to claim 18 or 19,

wherein, if the channel decoding module has indicated that the current bitstream payload comprises the one or more corrupted bits, and if the first part of the current bitstream payload does not comprise any of the one or more corrupted bits, the source decoding module is configured to select the partial frame loss concealment mode as the selected error concealment mode,

if the previous frame was not concealed using full frame loss concealment, and

if the highest spectral line among the plurality of spectral lines of the current audio signal portion exhibits said frequency being greater than said threshold frequency, and

if said stability factor is greater than or equal to said predefined threshold, and

if the first part of the current bitstream payload encodes a signal component which is tonal or harmonic, and if said highest spectral line among the plurality of spectral lines of the current audio signal portion exhibits a frequency being greater than the pitch frequency, and if the previous signal portion does not encode any peak of the audio signal being greater than said peak threshold value and which corresponds to said frequency being greater than all frequencies being indicated by the plurality of spectral lines of the current audio signal portion.

21. A decoder according to one of claims 8 to 20,

wherein, if the selected error concealment mode is the partial frame loss concealment mode, the source decoding module is configured to determine for each code word of a plurality of code words of the second part of the bitstream payload,

depending on a number of corrected symbols of said code word, whether or not to conduct error concealment for those of the plurality of spectral lines of the current audio signal portion being represented by said code word, and to conduct error concealment for said those of the plurality of spectral lines of the current audio signal portion, for which the source decoding module has determined that error concealment shall be conducted.

22. A decoder according to claim 21,

wherein, for each code word of a plurality of code words of the second part of the bitstream payload, the source decoding module is configured to determine a risk value indicating an approximation of a probability that said code word is corrupt, and to determine whether or not said risk value is greater than a risk threshold.

23. A decoder according to claim 21 or 22,

wherein, if said risk value is greater than said risk threshold, the source decoding module is configured to conduct error concealment for those of the plurality of spectral lines of the current audio signal portion being represented by said code word.

24. A decoder according to claim 23,

wherein the risk threshold is 2^{-16}.

25. A decoder according to one of claims 21 to 24,

wherein the source decoding module is configured to conduct said error concealment for said code word in the partial frame loss error concealment mode.

26. A decoder according to one of the preceding claims,

wherein the channel decoding module is configured to detect that the bitstream payload comprises one or more corrupted bits,

if the channel decoding module encounters an uncorrectable code word within the bitstream payload and/or

if the channel decoding module, after conducting error correction on a plurality of code words of the bitstream payload, determines a re-calculated hash value, which depends on said plurality of code words after the error correction, that differs from a received hash value.

27. A system, comprising:

an encoder for encoding a signal portion of a signal within a frame, wherein the encoder is configured to generate the frame so that the frame comprises a bitstream payload and two or more redundancy bits, wherein the bitstream payload comprises a plurality of payload bits, wherein each of the payload bits exhibits a position within the bitstream payload, and

a decoder according to one of the preceding claims.

28. A system comprising:

an encoder, and

a decoder,

wherein the encoder comprises a source encoding module for encoding a signal portion of a signal within a frame, wherein the source encoding module is configured to generate the frame so that the frame comprises a bitstream payload and two or more redundancy bits, wherein the bitstream payload comprises a plurality of payload bits, wherein each of the payload bits exhibits a position within the bitstream payload,

wherein the decoder is a decoder according to one of claims 1 to 26 being configured to process the frame being generated by the source encoding module, and

wherein the encoder comprises a channel encoding module being configured to generate the two or more redundancy bits depending on the bitstream payload.

29. A method for decoding a frame to reconstruct a signal portion of a signal, wherein the signal portion is encoded within the frame, wherein the frame comprises a bitstream payload and two or more redundancy bits, wherein the bitstream payload

comprises a plurality of payload bits, wherein each of the payload bits exhibits a position within the bitstream payload, wherein the method comprises:

detecting, depending on the two or more redundancy bits, whether the bitstream payload comprises one or more corrupted bits being one or more of the payload bits that are distorted or that are likely to be distorted,

if no corrupted bits have been detected within the bitstream payload, decoding the bitstream payload without conducting error concealment to reconstruct the signal portion, and

if one or more corrupted bits have been detected within the bitstream payload, selecting a selected error concealment mode of two or more error concealment modes depending on the position of at least one of the one or more corrupted bits within the bitstream payload and depending on a signal characteristic of the signal portion of the signal, and conducting error concealment depending on the selected error concealment mode to reconstruct the signal portion.

30. A method, comprising:

encoding a signal portion of a signal within a frame, wherein the frame is generated so that the frame comprises a bitstream payload and two or more redundancy bits, wherein the bitstream payload comprises a plurality of payload bits, wherein each of the payload bits exhibits a position within the bitstream payload, and

conducting the method for decoding of claim 29 using the frame.

31. A method for encoding a signal portion of a signal within a frame and for decoding the frame, wherein the method comprises:

generating the frame so that the frame comprises a bitstream payload and two or more redundancy bits, wherein the bitstream payload comprises a plurality of payload bits, wherein each of the payload bits exhibits a position within the bitstream payload,

generating the two or more redundancy bits depending on the bitstream payload, and

decoding the frame by conducting the method of claim 29.

32. A computer program for implementing a method according to one of claims 29 to 31 when being executed on a computer or signal processor.

33. A frame being generated according to the method of claim 31.