CLAIMS

1. A method of processing an audio signal, wherein the audio signal comprises a sequence of frames, each frame containing representations of a plurality of audio channels and reconstruction parameters for upmixing the plurality of audio channels to a predefined channel format, the method comprising:

receiving the audio signal; and

generating a reconstructed audio signal in the predefined channel format based on the received audio signal,

wherein generating the reconstructed audio signal comprises:

determining whether at least one frame of the audio signal has been lost; and

if a number of consecutively lost frames exceeds a first threshold, fading the reconstructed audio signal to a predefined spatial configuration.

2. The method according to claim 1, wherein the predefined spatial configuration corresponds to a spatially uniform audio signal; or

wherein the predefined spatial configuration corresponds to a predefined direction.

3. The method according to claim 1 or 2, wherein fading the reconstructed audio signal to the predefined spatial configuration involves linearly interpolating between a unit matrix and a target matrix indicative of the predefined spatial configuration, in accordance with a predefined fade-out time.

4. The method according to any one of claims 1 to 3, further comprising:

if the number of consecutively lost frames exceeds a second threshold that is greater than or equal to the first threshold, gradually fading out the reconstructed audio signal.

5. The method according to any one of claims 1 to 4, further comprising:

if at least one frame of the audio signal has been lost, generating estimations of the reconstruction parameters of the at least one lost frame based on the reconstruction parameters of an earlier frame; and

using the estimations of the reconstruction parameters of the at least one lost frame for generating the reconstructed audio signal of the at least one lost frame.

6. The method according to claim 5, wherein each reconstruction parameter is explicitly coded once every given number of frames in the sequence of frames and differentially coded between frames for the remaining frames; and

wherein estimating a given reconstruction parameter of a lost frame involves:

estimating the given reconstruction parameter of the lost frame based on the most recently determined value of the given reconstruction parameter; or

estimating the given reconstruction parameter of the lost frame based on the most recently determined values of one, two, or more reconstruction parameters other than the given reconstruction parameter.

7. The method according to claim 6, comprising:

determining a measure of reliability of the most recently determined value of the given reconstruction parameter; and

deciding, based on the measure of reliability, whether to estimate the given reconstruction parameter of the lost frame based on the most recently determined value of the given reconstruction parameter or based on the most recently determined values of the one, two, or more reconstruction parameters other than the given reconstruction parameter.

8. The method according to claim 6 or 7, comprising:

if the number of frames for which the value of the given reconstruction parameter could not be determined exceeds a third threshold, estimating the given reconstruction parameter of the lost frame based on the most recently determined values of the one, two, or more reconstruction parameters other than the given reconstruction parameter; and

otherwise, estimating the given reconstruction parameter of the lost frame based on the most recently determined value of the given reconstruction parameter.

9. The method according to any one of claims 5 to 8, wherein each frame contains reconstruction parameters relating to respective frequency bands, and wherein a given reconstruction parameter of the lost frame is estimated based on one or more reconstruction parameters relating to frequency bands different from a frequency band to which the given reconstruction parameter relates.

10. The method according to claim 9, wherein the given reconstruction parameter is estimated by interpolating between reconstruction parameters relating to frequency bands different from the frequency band to which the given reconstruction parameter relates.

11. The method according to claim 9 or 10, wherein the given reconstruction parameter is estimated by interpolating between reconstruction parameters relating to frequency bands neighboring the frequency band to which the given reconstruction parameter relates, or, if the frequency band to which the given reconstruction parameter relates has only one neighboring frequency band, by extrapolating from the reconstruction parameter relating to that neighboring frequency band.

12. A method of processing an audio signal, wherein the audio signal comprises a sequence of frames, each frame containing representations of a plurality of audio channels and reconstruction parameters for upmixing the plurality of audio channels to a predefined channel format, the method comprising:

receiving the audio signal; and

generating a reconstructed audio signal in the predefined channel format based on the received audio signal,

wherein generating the reconstructed audio signal comprises:

determining whether at least one frame of the audio signal has been lost; and

if at least one frame of the audio signal has been lost:

generating estimations of the reconstruction parameters of the at least one lost frame based on one or more reconstruction parameters of an earlier frame; and

using the estimations of the reconstruction parameters of the at least one lost frame for generating the reconstructed audio signal of the at least one lost frame.

13. The method according to claim 12, wherein each reconstruction parameter is explicitly coded once every given number of frames in the sequence of frames and differentially coded between frames for the remaining frames; and

wherein estimating a given reconstruction parameter of a lost frame involves:

estimating the given reconstruction parameter of the lost frame based on the most recently determined value of the given reconstruction parameter; or

estimating the given reconstruction parameter of the lost frame based on the most recently determined values of one, two, or more reconstruction parameters other than the given reconstruction parameter.

14. The method according to claim 13, comprising:

determining a measure of reliability of the most recently determined value of the given reconstruction parameter; and

deciding, based on the measure of reliability, whether to estimate the given reconstruction parameter of the lost frame based on the most recently determined value of the given reconstruction parameter or based on the most recently determined values of the one, two, or more reconstruction parameters other than the given reconstruction parameter.

15. The method according to claim 13 or 14, comprising:

if the number of frames for which the value of the given reconstruction parameter could not be determined exceeds a third threshold, estimating the given reconstruction parameter of the lost frame based on the most recently determined values of the one, two, or more reconstruction parameters other than the given reconstruction parameter; and

otherwise, estimating the given reconstruction parameter of the lost frame based on the most recently determined value of the given reconstruction parameter.

16. The method according to any one of claims 12 to 15, wherein each frame contains reconstruction parameters relating to respective frequency bands, and wherein a given reconstruction parameter of the lost frame is estimated based on one or more reconstruction parameters relating to frequency bands different from a frequency band to which the given reconstruction parameter relates.

17. The method according to claim 16, wherein the given reconstruction parameter is estimated by interpolating between reconstruction parameters relating to frequency bands different from the frequency band to which the given reconstruction parameter relates.

18. The method according to claim 16 or 17, wherein the given reconstruction parameter is estimated by interpolating between reconstruction parameters relating to frequency bands neighboring the frequency band to which the given reconstruction parameter relates, or, if the frequency band to which the given reconstruction parameter relates has only one neighboring

frequency band, by extrapolating from the reconstruction parameter relating to that neighboring frequency band.

19. A method of processing an audio signal, wherein the audio signal comprises a sequence of frames, each frame containing representations of a plurality of audio channels and reconstruction parameters for upmixing the plurality of audio channels to a predefined channel format, and wherein each reconstruction parameter is explicitly coded once every given number of frames in the sequence of frames and differentially coded between frames for the remaining frames, the method comprising:

receiving the audio signal; and

generating a reconstructed audio signal in the predefined channel format based on the received audio signal,

wherein generating the reconstructed audio signal comprises, for a given frame of the audio signal:

identifying reconstruction parameters that are correctly decoded and reconstruction parameters that cannot be correctly decoded due to missing differential base;

estimating the reconstruction parameters that cannot be correctly decoded based on correctly decoded reconstruction parameters of the given frame and/or correctly decoded reconstruction parameters of one or more earlier frames; and

using the correctly decoded reconstruction parameters and the estimated reconstruction parameters for generating the reconstructed audio signal of the given frame.

20. The method according to claim 19, wherein estimating a given reconstruction parameter that cannot be correctly decoded for the given frame involves:

estimating the given reconstruction parameter based on the most recent correctly decoded value of the given reconstruction parameter; or

estimating the given reconstruction parameter based on the most recent correctly decoded values of one, two, or more reconstruction parameters other than the given reconstruction parameter.

21. The method according to claim 20, comprising:

determining a measure of reliability of the most recent correctly decoded value of the given reconstruction parameter; and

deciding, based on the measure of reliability, whether to estimate the given reconstruction parameter based on the most recent correctly decoded value of the given reconstruction parameter or based on the most recent correctly decoded values of one, two, or more reconstruction parameters other than the given reconstruction parameter.

22. The method according to claim 20 or 21, comprising:

if the most recent correctly decoded value of the given reconstruction parameter is older than a predetermined threshold in units of frames, estimating the given reconstruction parameter based on the most recent correctly decoded values of the one, two, or more reconstruction parameters other than the given reconstruction parameter; and

otherwise, estimating the given reconstruction parameter based on the most recent correctly decoded value of the given reconstruction parameter.

23. The method according to any one of claims 19 to 22, wherein each frame contains reconstruction parameters relating to respective frequency bands, and wherein a given reconstruction parameter that cannot be correctly decoded for the given frame is estimated based on the most recent correctly decoded values of one or more reconstruction parameters relating to frequency bands different from a frequency band to which the given reconstruction parameter relates.

24. The method according to claim 23, wherein the given reconstruction parameter is estimated by interpolating between reconstruction parameters relating to frequency bands different from the frequency band to which the given reconstruction parameter relates.

25. The method according to claim 23 or 24, wherein the given reconstruction parameter is estimated by interpolating between reconstruction parameters relating to frequency bands neighboring the frequency band to which the given reconstruction parameter relates, or, if the frequency band to which the given reconstruction parameter relates has only one neighboring frequency band, by extrapolating from the reconstruction parameter relating to that neighboring frequency band.

26. A method of encoding an audio signal, wherein the encoded audio signal comprises a sequence of frames, each frame containing representations of a plurality of audio channels and

reconstruction parameters for upmixing the plurality of audio channels to a predetermined channel format, the method comprising, for each reconstruction parameter:

explicitly encoding the reconstruction parameter once every given number of frames in the sequence of frames; and

differentially encoding the reconstruction parameter between frames for the remaining frames,

wherein each frame contains at least one reconstruction parameter that is explicitly encoded and at least one reconstruction parameter that is differentially encoded with reference to an earlier frame, and wherein the sets of explicitly encoded and differentially encoded reconstruction parameters differ from one frame to the next.

27. An apparatus comprising a processor and a memory coupled to the processor and storing instructions for the processor, wherein the processor is configured to perform all steps of the method according to any one of claims 1 to 25.

28. An apparatus comprising a processor and a memory coupled to the processor and storing instructions for the processor, wherein the processor is configured to perform all steps of the method according to claim 26.

29. A computer program comprising instructions that, when executed by a computing device, cause the computing device to perform all steps of the method according to any one of claims 1 to 25.

30. A computer program comprising instructions that, when executed by a computing device, cause the computing device to perform all steps of the method according to claim 26.

31. A computer-readable storage medium storing the computer program according to claim 29 or 30.