Claims

1. A multi-channel audio decoder ~~(100; 700; 1550; 3000)~~ for providing at least two output audio signals ~~(112,114; 712,714; 1552a – 1552n; 3012)~~ on the basis of an encoded representation ~~(110; 710; 1516a, 1516b,1518)~~,

wherein the multi-channel audio decoder is configured to render ~~(130; 1580)~~ a plurality of decoded audio signals ~~(122; 1562a – 1562n, $\hat{X}$)~~, which are obtained on the basis of the encoded representation, to a multi-channel target scene in dependence on one or more rendering parameters ~~(132)~~ which define a rendering matrix, to obtain a plurality of rendered audio signals ~~(134, 136; 1582a-1582n, $\hat{Z}$)~~, and

wherein the multi-channel audio decoder is configured to derive ~~(140; 1590)~~ one or more decorrelated audio signals ~~(142,144; 1592a-1592n)~~ from the rendered audio signals, and

wherein the multi-channel audio decoder is configured to combine ~~(150;1598)~~ the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, to obtain the output audio signals;

wherein the multi-channel audio decoder is configured to obtain the decoded audio signals, which are rendered to obtain the plurality of rendered audio signals, using a parametric reconstruction ~~(120; 1560)~~.

wherein the decoded audio signals are reconstructed object signals, and

wherein the multi-channel audio decoder is configured to derive the reconstructed object signals from one or more downmix signals ~~(1516a, 1516b)~~ using a side information ~~(1518)~~.

2. The multi-channel audio decoder according to claim 1, wherein the multi-channel audio decoder is configured to derive un-mixing coefficients from the side information and to apply the un-mixing coefficients to derive the reconstructed object signals from the one or more downmix signals using the un-mixing coefficients.

3. The multi-channel audio decoder according to one of claims 1 to 2, wherein the multi-channel audio decoder is configured to combine the rendered audio signals with the one or more decorrelated audio signals, to at least partially achieve desired correlation characteristics or covariance characteristics of the output audio signals.

4. The multi-channel audio decoder according to one of claims 1 to 3, wherein the multi-channel audio decoder is configured to combine the rendered audio signals with the one or more decorrelated audio signals, to at least partially compensate for an energy loss during a parametric reconstruction ~~(120; 1560)~~ of the decoded audio signals ~~(122; 1562a to 1562n)~~, which are rendered to obtain the plurality of rendered audio signals.

5. The multi-channel audio decoder according to one of claims 1 to 4, wherein the multi-channel audio decoder is configured to determine desired correlation characteristics or desired covariance characteristics of the output audio signals, and

wherein the multi-channel audio decoder is configured to adjust a combination ~~(150; 1598)~~ of the rendered audio signals with the one or more decorrelated audio signals, to obtain the output audio signals, such that correlation characteristics or covariance characteristics of the obtained output audio signals approximate or equal the desired correlation characteristics or desired covariance characteristics ~~(C)~~.

6. The multi-channel audio decoder according to claim 5, wherein the multi-channel audio decoder is configured to determine the desired correlation characteristics or desired covariance characteristics ~~(C)~~ in dependence on a rendering information ~~(R)~~ describing a rendering ~~(130; 1560)~~ of the plurality of decoded audio signals ~~(Y)~~, which are obtained on the basis of the encoded representation, to obtain the plurality of rendered audio signals ~~(Z)~~.

7. The multi-channel audio decoder according to claim 5 or claim 6, wherein the multi-channel audio decoder is configured to determine the desired correlation

characteristics or desired covariance characteristics (C) in dependence on an object correlation information or an object covariance information (E_X) describing characteristics of a plurality of audio objects and/or a relationship between a plurality of audio objects.

8. The multi-channel audio decoder according to claim 7, wherein the multi-channel audio decoder is configured to determine the object correlation information or object covariance information (E_X) on the basis of a side information (1518) included in the encoded representation.

9. The multi-channel audio decoder according to one of claims 5 to 8, wherein the multi-channel audio decoder is configured to determine actual correlation characteristics or covariance characteristics (E_S) of the rendered audio signals and the one or more decorrelated audio signals, and

to adjust the combination (150;1598) of the rendered audio signals with the one or more decorrelated audio signals, to obtain the output audio signals, in dependence on the actual correlation characteristics or covariance characteristics (E_S) of the rendered audio signals and the one or more decorrelated audio signals.

10. The multi-channel audio decoder according to one of claims 1 to 9,

wherein the multi-channel audio decoder is configured to combine the rendered audio signals $\hat{\mathbf{Z}}$ with the one or more decorrelated audio signals **W**, to obtain the output audio signals $\tilde{\mathbf{Z}}$ according to

$$\tilde{\mathbf{Z}} = \mathbf{P}\hat{\mathbf{Z}} + \mathbf{M}\mathbf{W},$$

wherein **P** is a mixing matrix which is applied to the rendered audio signals $\hat{\mathbf{Z}}$, and

wherein **M** is a mixing matrix which is applied to the one or more decorrelated audio signals **W**.

11. The multi-channel audio decoder according to claim 10,

wherein the multi-channel audio decoder is configured to adjust at least one out of the mixing matrix **P** and the mixing matrix **M** such that correlation characteristics or covariance characteristics ~~($E_{\tilde{Z}}$)~~ of the obtained output audio signals $\tilde{\mathbf{Z}}$ approximate or equal the desired correlation characteristics or desired covariance characteristics ~~(**C**)~~.

12. The multi-channel audio decoder according to claim 10 or claim 11,

wherein the multi-channel audio decoder is configured to jointly compute the mixing matrix **P** and the mixing matrix **M**.

13. The multi-channel audio decoder according to one of claims 10 to 12,

wherein the multi-channel audio decoder is configured to obtain a combined mixing matrix **F**, with

$$\mathbf{F} = \begin{bmatrix} \mathbf{P} & \mathbf{M} \end{bmatrix}$$

such that a covariance matrix $E_{\tilde{Z}}$ of the obtained output audio signals $\tilde{\mathbf{Z}}$ approximates or equals a desired covariance matrix **C**.

14. The multi-channel audio decoder according to claim 13,

wherein the multi-channel audio decoder is configured to determine the combined mixing matrix **F** such that the covariance matrix

$$\mathbf{E}_{\tilde{Z}} = \mathbf{F}\mathbf{E}_S\mathbf{F}^H$$

is equal to the desired covariance matrix

$$\mathbf{C} = \mathbf{R}\mathbf{E}_X\mathbf{R}^H$$

wherein $\mathbf{E}_S$ is a covariance matrix of a signal **S** combining the rendered audio signals $\hat{\mathbf{Z}}$ and the one or more decorrelated audio signals **W**, which is defined as

$$\mathbf{S} = \begin{bmatrix} \hat{\mathbf{Z}} \\ \mathbf{W} \end{bmatrix}, \text{ and}$$

wherein $\mathbf{E}_X$ is an object covariance matrix.

15. The multi-channel audio decoder according to one of claims 1 to 9,

wherein the multi-channel audio decoder is configured to combine the rendered audio signals $\hat{\mathbf{Z}}$ with the one or more decorrelated audio signals **W**, to obtain the output audio signals $\tilde{\mathbf{Z}}$
according to

$$\tilde{\mathbf{Z}} = \mathbf{A}_{dry}\mathbf{P}\hat{\mathbf{Z}} + \mathbf{M}\mathbf{W}$$

or according to

$$\tilde{\mathbf{Z}} = \mathbf{P}\hat{\mathbf{Z}} + \mathbf{A}_{wet}\mathbf{M}\mathbf{W}$$

or according to

$$\tilde{\mathbf{Z}} = \mathbf{A}_{dry}\mathbf{P}\hat{\mathbf{Z}} + \mathbf{A}_{wet}\mathbf{M}\mathbf{W}$$

wherein **P** is a mixing matrix which is applied to the rendered audio signals $\hat{\mathbf{Z}}$, and

wherein **M** is a mixing matrix which is applied to the one or more decorrelated audio signals **W**

wherein $\mathbf{A}_{dry}$ is a first correction matrix or a first adjustment matrix,

wherein $\mathbf{A}_{wet}$ is a second correction matrix or a second adjustment matrix.

16. The multi-channel audio decoder according to claim 15,

wherein the multi-channel audio decoder is configured to adjust at least one out of the mixing matrix **P** and the mixing matrix **M** such that correlation characteristics or covariance characteristics ~~($E_{\tilde{Z}}$)~~ of the obtained output audio signals $\tilde{Z}$ or of audio signals obtained by a mixing of $\hat{\mathbf{Z}}$ and **W** using **P** and **M** approximate or equal the desired correlation characteristics or desired covariance characteristics ~~(C)~~.

17. The multi-channel audio decoder according to claim 15 or claim 16,

wherein the multi-channel audio decoder is configured to jointly compute the mixing matrix **P** and the mixing matrix **M**.

18. The multi-channel audio decoder according to one of claims 15 to 17,

wherein the multi-channel audio decoder is configured to obtain a combined mixing matrix **F**, with

$$\mathbf{F} = \begin{bmatrix} \mathbf{P} & \mathbf{M} \end{bmatrix}$$

such that a covariance matrix $E_{\tilde{Z}}$ of the obtained output audio signals $\tilde{Z}$ or a covariance matrix of audio signals obtained by a mixing of $\hat{\mathbf{Z}}$ and **W** using **P** and **M** approximates or equals a desired covariance matrix **C**.

19. The multi-channel audio decoder according to claim 18,

wherein the multi-channel audio decoder is configured to determine the combined mixing matrix **F** such that the covariance matrix

$$\mathbf{E}_{\tilde{Z}} = \mathbf{F}\mathbf{E}_{S}\mathbf{F}^{H}$$

is equal to the desired covariance matrix

$$\mathbf{C} = \mathbf{R}\mathbf{E}_X\mathbf{R}^H,$$

wherein $\mathbf{E}_S$ is a covariance matrix of a signal **S** combining the rendered audio signals $\hat{\mathbf{Z}}$ and the one or more decorrelated audio signals **W**, which is defined as

$$\mathbf{S} = \begin{bmatrix} \hat{\mathbf{Z}} \\ \mathbf{W} \end{bmatrix}, \text{ and}$$

wherein $\mathbf{E}_X$ is an object covariance matrix.

20. The multi-channel audio decoder according to one of claims 15 to 19,

wherein the multi-channel audio decoder is configured to determine the first correction matrix such that a contribution of the rendered audio signals onto the output audio signals is limited, and/or

wherein the multi-channel audio decoder is configured to determine the second correction matrix such that a contribution of the decorrelated audio signals onto the output audio signals is limited.

21. The multi-channel audio decoder according to one of claims 15 to 20,

wherein the multi-channel audio decoder is configured to determine the first correction matrix in dependence on properties of the rendered audio signals, and/or in dependence on properties of the decorrelated audio signals, and/or in dependence on properties of desired output audio signals, and/or in dependence on estimated properties of mixed rendered audio signals, and/or in dependence on estimated properties of mixed decorrelated audio signals, such that a contribution of the rendered audio signals onto the output audio signals is limited, and/or

wherein the multi-channel audio decoder is configured to determine the second correction matrix in dependence on a properties of the rendered audio signals, and/or in dependence on properties of the decorrelated audio signals, and/or in dependence on properties of desired output audio signals, and/or in dependence on estimated properties of mixed rendered audio signals, and/or in dependence

on estimated properties of mixed decorrelated audio signals, such that a contribution of the decorrelated audio signals onto the output audio signals is limited.

22. The multi-channel audio decoder according to claim 21, wherein the properties of the rendered audio signals, and/or of the decorrelated audio signals, and/or of the desired output audio signals, and/or of the mixed rendered audio signals, and/ or the mixed decorrelated audio signals are energy properties, or correlation properties, or covariance properties.

23. The multi-channel audio decoder according to one of claims 1 to 22,

wherein the multi-channel audio decoder is configured to combine the rendered audio signals $\widehat{\boldsymbol{Z}}$ with the one or more decorrelated audio signals **W**, to obtain the output audio signals $\widetilde{\boldsymbol{Z}}$
according to

$$\widetilde{\boldsymbol{Z}} = \boldsymbol{P}\widehat{\boldsymbol{Z}} + \boldsymbol{A}_{wet}\boldsymbol{M}\boldsymbol{W},$$

wherein the multi-channel audio decoder is configured to provide the correction matrix $\mathbf{A}_{wet}$ such that $\mathbf{A}_{wet}$ is a diagonal matrix and such that entries $\mathbf{A}_{wet}$ (i,i) of the correction matrix $\mathbf{A}_{wet}$ are reduced when compared to normal, unreduced diagonal entries of the correction matrix $\mathbf{A}_{wet}$ if a ratio between an intensity ($E_Y^{dry}(i,i)$) of a rendered audio signal and an intensity ($\hat{E}_Y^{wet}(i,i)$) of a mixed decorrelated audio signal, with mixing matrix **M**, in an i-th output audio signal would be smaller than a threshold value.

24. The multi-channel audio decoder according to claim 23, wherein the threshold value is a predetermined constant threshold value or wherein the threshold value is time-variant and/or frequency variant in dependence on signal properties, for example, energy properties, correlation properties and/or covariance properties.

25. The multi-channel audio decoder according to one of claims 1 to 24,

wherein the multi-channel audio decoder is configured to combine the rendered audio signals $\widehat{\boldsymbol{Z}}$ with the one or more decorrelated audio signals **W**, to obtain the output audio signals $\widetilde{\boldsymbol{Z}}$
according to

$$\widetilde{\boldsymbol{Z}} = \boldsymbol{P}\widehat{\boldsymbol{Z}} + \boldsymbol{A}_{wet}\boldsymbol{M}\boldsymbol{W},$$

wherein $\mathbf{P}=\mathbf{P}_{dry}$,

wherein $\mathbf{M}=\mathbf{P}_{wet}$,

wherein $\mathbf{A}_{wet} = \mathrm{matdiag}\left(\min\left(1, \sqrt{\max\left(0, \lambda_{Dec}\frac{\mathbf{E}_{\mathbf{Y}}^{dry}(i,i)}{\hat{\mathbf{E}}_{\mathbf{Y}}^{wet}(i,i)}\right)}\right)\right)$,

wherein E_Y^{dry} is a covariance matrix of the rendered audio signals $\widehat{\boldsymbol{Z}}$, and

wherin $\hat{E}_Y^{wet}$ is an estimated covariance matrix of the decorrelated audio signals after the matrix $\mathbf{P}_{wet}$ has been applied.

26. The multi-channel audio decoder according to claim 15, wherein the multi-channel audio decoder is configured to determine the combined mixing matrix **F** according to

$$\mathbf{F} = \left(\mathbf{U}\sqrt{\mathbf{T}}\mathbf{U}^H\right)\mathbf{H}\left(\mathbf{V}\sqrt{\mathbf{Q}^{-1}}\mathbf{V}^H\right),$$

where the matrices **U**, **T**, **V** and **Q** are determined using Singular Value Decomposition of the covariance matrices $\mathbf{E}_S$ and **C** yielding

$$\mathbf{C} = \mathbf{U}\mathbf{T}\mathbf{U}^H,$$

and

$$\mathbf{E}_S = \mathbf{V}\mathbf{Q}\mathbf{V}^H ,$$

wherein the matrix H is defined as

$$\mathbf{H} = \begin{bmatrix} a_{1,1} & 0 & \cdots & 0 & b_{1,1} & 0 & \cdots & 0 \\ 0 & a_{2,2} & \cdots & 0 & 0 & b_{2,2} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & a_{N,N} & 0 & 0 & \cdots & b_{N,N} \end{bmatrix}$$

wherein $a_{i,i}$ and $b_{i,i}$ are chosen such that

$$a_{i,i}^2 + b_{i,i}^2 = 1 .$$

27. The multi-channel audio decoder according to claim 10 or claim 11,

wherein the multi-channel audio decoder is configured to set the mixing matrix **P** to be an identity matrix, or a multiple thereof, and to compute the mixing matrix **M**.

28. The multi-channel audio decoder according to claim 27, wherein the multi-channel audio decoder is configured to determine the mixing matrix **M** such that a difference Δ_E between the desired covariance matrix **C** and a covariance matrix $E_{\hat{Z}}$, which is defined as

$$\Delta_E = \mathbf{C} - \mathbf{E}_{\hat{Z}}$$

is equal to, or approximates, a covariance

$$\mathbf{M}\mathbf{E}_W\mathbf{M}^H ,$$

wherein the desired covariance matrix **C** is defined as

$$\mathbf{C} = \mathbf{R}\mathbf{E}_X\mathbf{R}^H ,$$

wherein **R** is a rendering matrix,

wherein $\mathbf{E}_X$ is an object covariance matrix, and

wherein $\mathbf{E}_W$ is a covariance matrix of the one or more decorrelated signals, and

wherein $E_{\tilde{Z}}$ is a covariance matrix of the rendered audio signals.

29. The multi-channel audio decoder according to claim 28,

wherein the multi-channel audio decoder is configured to determine the mixing matrix **M** according to

$$\mathbf{M} = \left(\mathbf{U}\sqrt{\mathbf{T}}\mathbf{U}^H\right)\left(\mathbf{V}\sqrt{\mathbf{Q}^{-1}}\mathbf{V}^H\right),$$

where the matrices **U**, **T**, **V** and **Q** are determined using Singular Value Decomposition of the covariance matrices Δ_E and $\mathbf{E}_W$ yielding

$$\Delta_E = \mathbf{U}\mathbf{T}\mathbf{U}^H$$

and

$$\mathbf{E}_W = \mathbf{V}\mathbf{Q}\mathbf{V}^H .$$

30. The multi-channel audio decoder according to claim 10 or claim 11,

wherein the multi-channel audio decoder is configured to determine the mixing matrices **P**, **M** under the restriction that a given rendered audio signal is only mixed with a decorrelated version of the given rendered audio signal itself.

31. The multi-channel audio decoder according to claim 10 or claim 11 or claim 30, wherein the multi-channel audio decoder is configured to combine the rendered audio signals with the one or more decorrelated audio signals such that only autocorrelation values or autocovariance values of rendered audio signals are

modified while cross-correlation values or cross-covariance values are left unchanged.

32. The multi-channel audio decoder according to claim 10 or claim 11 or claim 30 or claim 31,

wherein the multi-channel audio decoder is configured to set the mixing matrix **P** to be an identity matrix, or a multiple thereof, and to compute the mixing matrix **M** under the restriction that **M** is a diagonal matrix.

33. The multi-channel audio decoder according to claim 30 or 31 or 32, wherein the multi-channel audio decoder is configured to combine the rendered audio signals $\hat{\mathbf{Z}}$ with the one or more decorrelated audio signals **W**, to obtain the output audio signals $\tilde{\mathbf{Z}}$ according to

$$\tilde{\mathbf{Z}} = \hat{\mathbf{Z}} + \mathbf{MW},$$

wherein **M** is a diagonal mixing matrix which is applied to the one or more decorrelated audio signals **W**, and

wherein the multi-channel audio decoder is configured to compute diagonal elements of the mixing matrix **M** such that diagonal elements of a covariance matrix of the output audio signals are equal to desired energies.

34. The multi-channel audio decoder according to claim 33, wherein the multi-channel audio decoder is configured to compute the elements of the mixing matrix **M** according to

$$\mathbf{M}(i,j) = \begin{cases} \sqrt{\min\left(\lambda_{Dec}, \max\left(0, \dfrac{\mathbf{C}(i,i) - \mathbf{E}_{\hat{z}}(i,i)}{\max\left(\mathbf{E}_{W}(i,i), \varepsilon\right)}\right)\right)} & i = j, \\ 0 & i \neq j. \end{cases},$$

wherein the desired covariance matrix **C** is defined as

$$\mathbf{C} = \mathbf{R}\mathbf{E}_X\mathbf{R}^H,$$

wherein **R** is a rendering matrix,

wherein $\mathbf{E}_X$ is an object covariance matrix,

wherein $\mathbf{E}_W$ is a covariance matrix of the of the one or more decorrelated signals, and

wherein λ_{Dec} is a threshold value limiting an amount of decorrelation added to the signals.

35. The multi-channel audio decoder according to one of claims 1 to 34, wherein the multi-channel audio decoder is configured to consider correlation characteristics or covariance characteristics of the decorrelated audio signals when determining how to combine the rendered audio signals, or the scaled version thereof, with the one or more decorrelated audio signals.

36. The multi-channel audio decoder according to one of claims 1 to 26 or 35, wherein the multi-channel audio decoder is configured to mix rendered audio signals and decorrelated audio signals, such that a given output audio signal is provided on the basis of two or more rendered audio signals and at least one decorrelated audio signal.

37. The multi-channel audio decoder according to one of claims 1 to 36, wherein the multi-channel audio decoder is configured to switch between different modes, in which different restrictions are applied for determining how to combine the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, to obtain the output audio signals.

38. The multi-channel audio decoder according to one of claims 1 to 37, wherein the multi-channel audio decoder is configured to switch between

a first mode, in which a mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals,

a second mode in which no mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, and in which it is allowed that a given decorrelated signal is combined, with same or different scaling, with a plurality of rendered audio signals, or a scaled version thereof, in order to adjust cross-correlation characteristics or cross-covariance characteristics of the output audio signals, and

a third mode in which no mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, and in which it is not allowed that a given decorrelated signal is combined with rendered audio signals other than a rendered audio signal from which the given decorrelated signal is derived.

39. The multi-channel audio decoder according to claim 37 or claim 38, wherein the multi-channel audio decoder is configured to evaluate a bitstream element of the encoded representation indicating which of the three modes for combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals is to be used, and to select the mode in dependence on said bitstream element.

40. A multi-channel audio encoder ~~(200; 1510; 2900)~~for providing an encoded representation ~~(214; 1516a, 1516b, 1518; 2932)~~ on the basis of at least two input audio signals ~~(210,212; 1512a-1512n; 2912, 2914)~~,

wherein the multi-channel audio encoder is configured to provide ~~(220)~~ one or more downmix signals ~~(222; 1516a,1516b)~~ on the basis of the at least two input audio signals, and

wherein the multi-channel audio encoder is configured to provide ~~(230)~~ one or more parameters ~~(232; 1518)~~ describing a relationship between the at least two input audio signals, and

wherein the multi-channel audio encoder is configured to provide ~~(240)~~ a decorrelation method parameter ~~(242; 1518)~~ describing which decorrelation mode

out of a plurality of decorrelation modes should be used at the side of an audio decoder;

wherein the multi-channel audio encoder is configured to selectively provide the decorrelation method parameter, to signal one out of the following three modes for the operation of an audio decoder:

a first mode, in which a mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals,

a second mode in which no mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, and in which it is allowed that a given decorrelated signal is combined, with same or different scaling, with a plurality of rendered audio signals, or a scaled version thereof, in order to adjust cross-correlation characteristics or cross-covariance characteristics of the output audio signals, and

a third mode in which no mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, and in which it is not allowed that a given decorrelated signal is combined with rendered audio signals other than a rendered audio signal from which the given decorrelated signal is derived.

41. The multi-channel audio encoder according to claim 40, wherein the multi-channel audio encoder is configured to select the decorrelation method parameter in dependence on whether the input audio signals comprise a comparatively high correlation or a comparatively lower correlation.

42. The multi-channel audio encoder according to claim 40 or 41, wherein the multi-channel audio encoder is configured to select the decorrelation method parameter to designate the first mode or the second mode if a correlation between the input audio signals is comparatively high, and

wherein the multi-channel audio encoder is configured to select the decorrelation method parameter to designate the third mode if a correlation between the input audio signals is comparatively lower.

43. A method ~~(300)~~ for providing at least two output audio signals on the basis of an encoded representation, the method comprising:

rendering ~~(310)~~ a plurality of decoded audio signals, which are obtained on the basis of the encoded representation, to a multi-channel target scene in dependence on one or more rendering parameters which define a rendering matrix, to obtain a plurality of rendered audio signals,

deriving ~~(320)~~ one or more decorrelated audio signals from the rendered audio signals, and

combining ~~(330)~~ the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, to obtain the output audio signals;

wherein the decoded audio signals, which are rendered to obtain the plurality of rendered audio signals, are obtained using a parametric reconstruction ~~(120; 1560)~~;

wherein the decoded audio signals are reconstructed object signals; and

wherein the reconstructed object signals are derived from one or more downmix signals ~~(1516a, 1516b)~~ using a side information ~~(1518)~~.

44. A method ~~(400)~~ for providing an encoded representation on the basis of at least two input audio signals, the method comprising:

providing ~~(410)~~ one or more downmix signals on the basis of the at least two input audio signals,

providing ~~(420)~~ one or more parameters describing a relationship between the at least two input audio signals, and

providing ~~(430)~~ a decorrelation method parameter describing which decorrelation mode out of a plurality of decorrelation modes should be used at the side of an audio decoder;

wherein the method comprises selectively providing the decorrelation method parameter, to signal one out of the following three modes for the operation of an audio decoder:

a first mode, in which a mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals,

a second mode in which no mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, and in which it is allowed that a given decorrelated signal is combined, with same or different scaling, with a plurality of rendered audio signals, or a scaled version thereof, in order to adjust cross-correlation characteristics or cross-covariance characteristics of the output audio signals, and

a third mode in which no mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, and in which it is not allowed that a given decorrelated signal is combined with rendered audio signals other than a rendered audio signal from which the given decorrelated signal is derived.

45. A computer program for performing the method according to claim 43 or claim 44 when the computer program runs on a computer.

46. An encoded audio representation ~~(500)~~, comprising:

an encoded representation ~~(510)~~ of a downmix signal;

an encoded representation ~~(520)~~ of one or more parameters describing a relationship between the at least two input audio signals, and

an encoded decorrelation method parameter~~(530)~~ describing which decorrelation mode out of a plurality of decorrelation modes should be used at the side of an audio decoder;

wherein the decorrelation method parameter signals one out of the following three modes for the operation of an audio decoder:

a first mode, in which a mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals,

a second mode in which no mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, and in which it is allowed that a given decorrelated signal is combined, with same or different scaling, with a plurality of rendered audio signals, or a scaled version thereof, in order to adjust cross-correlation characteristics or cross-covariance characteristics of the output audio signals, and

a third mode in which no mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, and in which it is not allowed that a given decorrelated signal is combined with rendered audio signals other than a rendered audio signal from which the given decorrelated signal is derived.

47. A multi-channel audio decoder ~~(100; 700; 1550; 3000)~~ for providing at least two output audio signals ~~(112,114; 712,714; 1552a – 1552n; 3012)~~ on the basis of an encoded representation ~~(110; 710; 1516a, 1516b,1518)~~,

wherein the multi-channel audio decoder is configured to render ~~(130; 1580)~~ a plurality of decoded audio signals ~~(122; 1562a – 1562n, $\hat{Y}$)~~, which are obtained on the basis of the encoded representation, in dependence on one or more rendering parameters ~~(132)~~, to obtain a plurality of rendered audio signals ~~(134, 136; 1582a-1582n, $\hat{Z}$)~~, and

wherein the multi-channel audio decoder is configured to derive ~~(140; 1590)~~ one or more decorrelated audio signals ~~(142,144; 1592a-1592n)~~ from the rendered audio signals, and

wherein the multi-channel audio decoder is configured to combine ~~(150;1598)~~ the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, to obtain the output audio signals;

wherein the multi-channel audio decoder is configured to switch between

a first mode, in which a mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals,

a second mode in which no mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, and in which it is allowed that a given decorrelated signal is combined, with same or different scaling, with a plurality of rendered audio signals, or a scaled version thereof, in order to adjust cross-correlation characteristics or cross-covariance characteristics of the output audio signals, and

a third mode in which no mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, and in which it is not allowed that a given decorrelated signal is combined with rendered audio signals other than a rendered audio signal from which the given decorrelated signal is derived.

48. A method ~~(300)~~ for providing at least two output audio signals on the basis of an encoded representation, the method comprising:

rendering ~~(310)~~ a plurality of decoded audio signals, which are obtained on the basis of the encoded representation, in dependence on one or more rendering parameters, to obtain a plurality of rendered audio signals,

deriving ~~(320)~~ one or more decorrelated audio signals from the rendered audio signals, and

combining ~~(330)~~ the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, to obtain the output audio signals;

wherein the method comprises switching between

a first mode, in which a mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals,

a second mode in which no mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, and in which it is allowed that a given decorrelated signal is combined, with same or different scaling, with a plurality of rendered audio signals, or a scaled version thereof, in order to adjust cross-correlation characteristics or cross-covariance characteristics of the output audio signals, and

a third mode in which no mixing between different rendered audio signals is allowed when combining the rendered audio signals, or a scaled version thereof, with the one or more decorrelated audio signals, and in which it is not allowed that a given decorrelated signal is combined with rendered audio signals other than a rendered audio signal from which the given decorrelated signal is derived.

49. A computer program for performing the method according to claim 48 when the computer program runs on a computer.