channel decorrelatorto be equal to a mixing matrix which is used by a format converter or renderer which receives the at least two output audio signals.

26. A multi-channel audio encoder for providing an encoded representation on the basis of at least two input audio signals,

wherein the multi-channel audio encoder is configured to provide one or more downmix signals on the basis of the at least two input audio signals, and

wherein the multi-channel audio encoder is configured to provide one or more parameters describing a relationship between the at least two input audio signals, and

wherein the multi-channel audio encoder is configured to provide a decorrelation complexity parameter describing a complexity of a decorrelation to be used at the side of an audio decoder, and

wherein the decorrelation complexity parameter determines a number K of decorrelators to be used in a multi-channel decorrelator premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, or

wherein the decorrelation complexity parameter determines a selection of a premixing matrix used to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals in a multi-channel decorrelator.

27. A method for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals, the method comprising:

premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

providing a first set of K’ decorrelator output signals on the basis of the second set of K decorrelator input signals; and

upmixing the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K'.

wherein the first set $\hat{\boldsymbol{Z}}$ of N decorrelator input signals is premixed into the second set $\hat{\boldsymbol{Z}}_{mix}$ of K decorrelator input signals using a premixing matrix $\mathbf{M}_{pre}$ according to

$$\hat{\mathbf{Z}}_{mix} = \mathbf{M}_{pre}\hat{\mathbf{Z}}$$

wherein the first set $\hat{\boldsymbol{Z}}_{mix}^{dec}$ of K' decorrelator output signals is obtained on the basis of the second set $\hat{\boldsymbol{Z}}_{mix}$ of K decorrelator input signals, and

wherein the first set $\hat{\boldsymbol{Z}}_{mix}^{dec}$ of K' decorrelator output signals is upmixed into the second set **W** of N' decorrelator output signals using a postmixing matrix $\mathbf{M}_{post}$ according to

$$\mathbf{W} = \mathbf{M}_{post}\hat{\mathbf{Z}}_{mix}^{dec},$$

wherein the premixing matrix $\mathbf{M}_{pre}$ is selected in dependence on spatial positions to which the channel signals of the first set $\hat{\boldsymbol{Z}}$ of N decorrelator input signals are associated

28. A method for providing at least two output audio signals on the basis of an encoded representation,

wherein the method comprises providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals according to claim 27.

29. A method for providing an encoded representation on the basis of at least two input audio signals, the method comprising:

providing one or more downmix signals on the basis of the at least two input audio signals, and

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

providing a decorrelation complexity parameter describing a complexity of a decorrelation to be used at the side of an audio decoder, and

wherein the decorrelation complexity parameter determines a number K of decorrelators to be used in a multi-channel decorrelator premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, or

wherein the decorrelation complexity parameter determines a selection of a premixing matrix used to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals in a multi-channel decorrelator.

30. A computer program for performing the method of claim 27, claim 28 or claim 29 when the computer program runs on a computer.

31. An encoded audio representation, comprising:

an encoded representation of a downmix signal;

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

an encoded decorrelation complexity parameter describing a complexity of a decorrelation to be used at the side of an audio decoder, and

wherein the decorrelation complexity parameter determines a number K of decorrelators to be used in a multi-channel decorrelator premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, or

wherein the decorrelation complexity parameter determines a selection of a premixing matrix used to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals in a multi-channel decorrelator.

32. A multi-channel decorrelator for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein the multi-channel decorrelator is configured to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

wherein the multi-channel decorrelator is configured to provide a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

wherein the multi-channel decorrelator is configured to upmix the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the multi-channel decorrelator is configured to premix the first set $\hat{\boldsymbol{Z}}$ of N decorrelator input signals into the second set $\hat{\boldsymbol{Z}}_{mix}$ of K decorrelator input signals using a premixing matrix $\mathbf{M}_{pre}$ according to

$$\hat{\mathbf{Z}}_{mix} = \mathbf{M}_{pre}\hat{\mathbf{Z}}$$

wherein the multi-channel decorrelator is configured to obtain the first set $\hat{\boldsymbol{Z}}_{mix}^{dec}$ of K' decorrelator output signals on the basis of the second set $\hat{\boldsymbol{Z}}_{mix}$ of K decorrelator input signals, and

wherein the multi-channel decorrelator is configured to upmix the first set $\hat{\boldsymbol{Z}}_{mix}^{dec}$ of K' decorrelator output signals into the second set $\mathbf{W}$ of N' decorrelator output signals using a postmixing matrix $\mathbf{M}_{post}$ according to

$$\mathbf{W} = \mathbf{M}_{post}\hat{\mathbf{Z}}_{mix}^{dec},$$

wherein the multi-channel decorrelator is configured to select the premixing matrix $\mathbf{M}_{pre}$ in dependence on correlation characteristics or covariance characteristics of the channel signals of the first set $\hat{\boldsymbol{Z}}$ of N decorrelator input signals.

33. A multi-channel decorrelator for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein the multi-channel decorrelator is configured to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

wherein the multi-channel decorrelator is configured to provide a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

wherein the multi-channel decorrelator is configured to upmix the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the multi-channel decorrelator is configured to premix the first set $\hat{\boldsymbol{Z}}$ of N decorrelator input signals into the second set $\hat{\boldsymbol{Z}}_{mix}$ of K decorrelator input signals using a premixing matrix $\mathbf{M}_{pre}$ according to

$$\hat{\mathbf{Z}}_{mix} = \mathbf{M}_{pre}\hat{\mathbf{Z}}$$

wherein the multi-channel decorrelator is configured to obtain the first set $\hat{\boldsymbol{Z}}_{mix}^{dec}$ of K' decorrelator output signals on the basis of the second set $\hat{\boldsymbol{Z}}_{mix}$ of K decorrelator input signals, and

wherein the multi-channel decorrelator is configured to upmix the first set $\hat{\boldsymbol{Z}}_{mix}^{dec}$ of K' decorrelator output signals into the second set $\mathbf{W}$ of N' decorrelator output signals using a postmixing matrix $\mathbf{M}_{post}$ according to

$$\mathbf{W} = \mathbf{M}_{post}\hat{\mathbf{Z}}_{mix}^{dec},$$

wherein the multi-channel decorrelator is configured to obtain the postmixing matrix $\mathbf{M}_{post}$ according to

$$\boldsymbol{M_{post} = M_{pre}^{H}(M_{pre}M_{pre}^{H})^{-1}}.$$

34. A multi-channel decorrelator for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein the multi-channel decorrelator is configured to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

wherein the multi-channel decorrelator is configured to provide a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

wherein the multi-channel decorrelator is configured to upmix the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the multi-channel decorrelator is configured to receive an information about a rendering configuration associated with the channel signals of the first set of N decorrelator input signals, and wherein the multi-channel decorrelator is configured to select a premixing matrix in dependence on the information about the rendering configuration.

35. A multi-channel decorrelator for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein the multi-channel decorrelator is configured to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

wherein the multi-channel decorrelator is configured to provide a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

wherein the multi-channel decorrelator is configured to upmix the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the multi-channel decorrelator is configured to combine channel signals of the first set of N decorrelator input signals which are associated with spatially adjacent positions of an audio scene when performing the premixing.

36. A multi-channel decorrelator for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein the multi-channel decorrelator is configured to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

wherein the multi-channel decorrelator is configured to provide a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

wherein the multi-channel decorrelator is configured to upmix the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the multi-channel decorrelator is configured to combine channel signals of the first set of N decorrelator input signals which are associated with a horizontal pair of spatial positions comprising a left side position and a right side position.

37. A multi-channel decorrelator for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein the multi-channel decorrelator is configured to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

wherein the multi-channel decorrelator is configured to provide a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

wherein the multi-channel decorrelator is configured to upmix the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the multi-channel decorrelator is configured to combine at least four channel signals of the first set of N decorrelator input signals, wherein at least two of said at least four channel signals are associated with spatial positions on a left side of an audio scene, and wherein at least two of said at least four channel signals are associated with spatial positions on a right side of the audio scene.

38. A multi-channel decorrelator for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein the multi-channel decorrelator is configured to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

wherein the multi-channel decorrelator is configured to provide a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

wherein the multi-channel decorrelator is configured to upmix the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the multi-channel decorrelator is configured to receive a complexity information describing a number K of decorrelator input signals of the second set of decorrelator input signals, and wherein the multi-channel decorrelator is configured to select a premixing matrix in dependence on the complexity information.

39. A multi-channel audio decoder for providing at least two output audio signals on the basis of an encoded representation,

wherein the multi-channel audio decoder comprises a multi-channel decorrelator for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein the multi-channel decorrelator is configured to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

wherein the multi-channel decorrelator is configured to provide a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

wherein the multi-channel decorrelator is configured to upmix the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the multi-channel audio decoder is configured to select a premixing matrix for usage by the multi-channel decorrelator in dependence on an output configuration describing an allocation of the output audio signals with spatial positions of an audio scene.

40. A multi-channel audio decoder for providing at least two output audio signals on the basis of an encoded representation,

wherein the multi-channel audio decoder comprises a multi-channel decorrelator for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein the multi-channel decorrelator is configured to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

wherein the multi-channel decorrelator is configured to provide a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

wherein the multi-channel decorrelator is configured to upmix the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the multi-channel audio decoder is configured to select between three or more different premixing matrices for usage by the multi-channel decorrelator in dependence on a control information included in the encoded representation for a given output configuration, wherein each of the three or more different premixing

matrices is associated with a different number of signals of the second set of K decorrelator input signals.

41. A multi-channel audio decoder for providing at least two output audio signals on the basis of an encoded representation,

wherein the multi-channel audio decoder comprises a multi-channel decorrelator for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein the multi-channel decorrelator is configured to premix a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

wherein the multi-channel decorrelator is configured to provide a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

wherein the multi-channel decorrelator is configured to upmix the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the multi-channel audio decoder is configured to select a premixing matrix for usage by the multi-channel decorrelator in dependence on a mixing matrix which is used by an format converter or renderer which receives the at least two output audio signals.

42. A method for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals, the method comprising:

premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

providing a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

upmixing the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the first set $\hat{\boldsymbol{Z}}$ of N decorrelator input signals is premixed into the second set $\hat{\boldsymbol{Z}}_{mix}$ of K decorrelator input signals using a premixing matrix $\mathbf{M}_{pre}$ according to

$$\hat{\mathbf{Z}}_{mix} = \mathbf{M}_{pre}\hat{\mathbf{Z}}$$

wherein the first set $\hat{\boldsymbol{Z}}_{mix}^{dec}$ of K' decorrelator output signals is obtained on the basis of the second set $\hat{\boldsymbol{Z}}_{mix}$ of K decorrelator input signals, and

wherein the first set $\hat{\boldsymbol{Z}}_{mix}^{dec}$ of K' decorrelator output signals is upmixed into the second set **W** of N' decorrelator output signals using a postmixing matrix $\mathbf{M}_{post}$ according to

$$\mathbf{W} = \mathbf{M}_{post}\hat{\mathbf{Z}}_{mix}^{dec};$$

wherein the premixing matrix $\mathbf{M}_{pre}$ is selected in dependence on correlation characteristics or covariance characteristics of the channel signals of the first set $\hat{\boldsymbol{Z}}$ of N decorrelator input signals.

43. A method for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals, the method comprising:

premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

providing a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

upmixing the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein he first set $\hat{\boldsymbol{Z}}$ of N decorrelator input signals is premixed into the second set $\hat{\boldsymbol{Z}}_{mix}$ of K decorrelator input signals using a premixing matrix $\mathbf{M}_{pre}$ according to

$$\hat{\mathbf{Z}}_{mix} = \mathbf{M}_{pre}\hat{\mathbf{Z}}$$

wherein the first set $\hat{\boldsymbol{Z}}_{mix}^{dec}$ of K' decorrelator output signals is obtained on the basis of the second set $\hat{\boldsymbol{Z}}_{mix}$ of K decorrelator input signals, and

wherein the first set $\hat{\boldsymbol{Z}}_{mix}^{dec}$ of K' decorrelator output signals is upmixed into the second set **W** of N' decorrelator output signals using a postmixing matrix $\mathbf{M}_{post}$ according to

$$\mathbf{W} = \mathbf{M}_{post}\hat{\mathbf{Z}}_{mix}^{dec};$$

wherein the postmixing matrix $\mathbf{M}_{post}$ is obtained according to

$$\boldsymbol{M_{post} = M_{pre}^{H}(M_{pre}M_{pre}^{H})^{-1}.}$$

44. A method for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals, the method comprising:

premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

providing a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

upmixing the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the method comprises receiving an information about a rendering configuration associated with the channel signals of the first set of N decorrelator

input signals, and wherein a premixing matrix is selected in dependence on the information about the rendering configuration.

45. A method for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals, the method comprising:

premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

providing a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

upmixing the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein channel signals of the first set of N decorrelator input signals which are associated with spatially adjacent positions of an audio scene are combined when performing the premixing.

46. A method for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals, the method comprising:

premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

providing a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

upmixing the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein channel signals of the first set of N decorrelator input signals which are associated with a horizontal pair of spatial positions comprising a left side position and a right side position are combined.

47. A method for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals, the method comprising:

premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

providing a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

upmixing the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein at least four channel signals of the first set of N decorrelator input signals are combined, wherein at least two of said at least four channel signals are associated with spatial positions on a left side of an audio scene, and wherein at least two of said at least four channel signals are associated with spatial positions on a right side of the audio scene.

48. A method for providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals, the method comprising:

premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

providing a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

upmixing the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the method comprises receiving a complexity information describing a number K of decorrelator input signals of the second set of decorrelator input signals, and wherein a premixing matrix is selected in dependence on the complexity information.

49. A method for providing at least two output audio signals on the basis of an encoded representation,

wherein the method comprises providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals comprises:

premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

providing a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

upmixing the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein a premixing matrix for usage by the multi-channel decorrelator is selected in dependence on an output configuration describing an allocation of the output audio signals with spatial positions of an audio scene.

50. A method for providing at least two output audio signals on the basis of an encoded representation,

wherein the method comprises providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals comprises:

premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

providing a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

upmixing the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein the method comprises selecting between three or more different premixing matrices for usage by the multi-channel decorrelator in dependence on a control information included in the encoded representation for a given output configuration, wherein each of the three or more different premixing matrices is associated with a different number of signals of the second set of K decorrelator input signals.

51. A method for providing at least two output audio signals on the basis of an encoded representation,

wherein the method comprises providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals,

wherein providing a plurality of decorrelated signals on the basis of a plurality of decorrelator input signals comprises:

premixing a first set of N decorrelator input signals into a second set of K decorrelator input signals, wherein K<N;

providing a first set of K' decorrelator output signals on the basis of the second set of K decorrelator input signals; and

upmixing the first set of K' decorrelator output signals into a second set of N' decorrelator output signals, wherein N'>K';

wherein a premixing matrix for usage by the multi-channel decorrelator is selected in dependence on a mixing matrix which is used by an format converter or renderer which receives the at least two output audio signals.

52. A computer program for performing the method of any one of claims 42 to 51 when the computer program runs on a computer.

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