Claims

1. Apparatus for processing an encoded audio signal comprising a plurality of downmix signals associated with a plurality of input audio objects and object parameters **E**,
comprising:
a grouper configured to group said plurality of downmix signals into a plurality of groups of downmix signals based on information within said encoded audio signal, wherein each group of downmix signals is associated with a set of input audio objects of said plurality of input audio objects,
a processor configured to perform at least one processing step individually on the object parameters $\mathbf{E}_k$ of each set of input audio objects in order to provide group results, and
a combiner configured to combine said group results in order to provide a decoded audio signal,
wherein said grouper is configured to group said plurality of downmix signals into said plurality of groups of downmix signals so that each input audio object of said plurality of input audio objects belongs to just one set of input audio objects, and
wherein said grouper is configured to group said plurality of downmix signals into said plurality of groups of downmix signals so that each input audio object of each set of input audio objects either is free from a relation signaled in the encoded audio signal with other input audio objects or has a relation signaled in the encoded audio signal only with at least one input audio object belonging to the same set of input audio objects.

2. Apparatus of claim 1, wherein said grouper is configured to group said plurality of downmix signals into said plurality of groups of downmix signals while minimizing a number of downmix signals within each group of downmix signals.

3. Apparatus of claim 1 or 2, wherein said grouper is configured to group said plurality of downmix signals into said plurality of groups of downmix signals so that just one single downmix signal belongs to one group of downmix signals.

4. Apparatus of any of claims 1 to 3,

wherein said grouper is configured to group said plurality of downmix signals into said plurality of groups of downmix signals by applying at least the following steps:
detecting whether a downmix signal is assigned to an existing group of downmix signals;
detecting whether at least one input audio object of the plurality of input audio objects associated with the downmix signal is part of a set of input audio objects associated with an existing group of downmix signals;
assigning the downmix signal to a new group of downmix signals in case the downmix signal is free from an assignment to an existing group of downmix signals and in case all input audio objects of the plurality of input audio objects associated with the downmix signal are free from an association with an existing group of downmix signals; and
combining the downmix signal with an existing group of downmix signals either in case the downmix signal is assigned to the existing group of downmix signals or in case at least one input audio object of the plurality of input audio objects associated with the downmix signal is associated with the existing group of downmix signals.

5. Apparatus of any of claims 1 to 4,
wherein said processor is configured to perform various processing steps individually on the object parameters $\mathbf{E}_k$ of each set of input audio objects in order to provide individual matrices as group results, and
wherein said combiner is configured to combine said individual matrices.

6. Apparatus of any of claims 1 to 5,
wherein said processor is configured to perform at least one processing step individually on the object parameters $\mathbf{E}_k$ of each set of input audio objects in order to provide individual matrices,
wherein said apparatus comprises a post-processor configured to process jointly object parameters in order to provide at least one overall matrix, and
wherein said combiner is configured to combine said individual matrices and said at least one overall matrix.

7. Apparatus of any of claims 1 to 6,

wherein said processor comprises a calculator configured to compute individually for each group of downmix signals matrices with sizes depending on at least one of a number of input audio objects of the set of input audio objects associated with the respective group of downmix signals and a number of downmix signals belonging to the respective group of downmix signals.

8. Apparatus of any of claims 1 to 7,
wherein processor is configured to compute for each group of downmix signals an individual threshold based on a maximum energy value within the respective group of downmix signals.

9. Apparatus of any of claims 1 to 8,
wherein said processor is configured to determine an individual downmixing matrix $\mathbf{D}_k$ for each group of downmix signals,
wherein said processor is configured to determine an individual group covariance matrix $\mathbf{E}_k$ for each group of downmix signals,
wherein said processor is configured to determine an individual group downmix covariance matrix $\mathbf{\Delta}_k$ for each group of downmix signals based on the individual downmixing matrix $\mathbf{D}_k$ and the individual group covariance matrix $\mathbf{E}_k$, and
wherein said processor is configured to determine an individual regularized inverse group matrix $\mathbf{J}_k$ for each group of downmix signals.

10. Apparatus of claim 9,
wherein said combiner is configured to combine the individual regularized inverse group matrices $\mathbf{J}_k$ to obtain an overall regularized inverse group matrix $\mathbf{J}$.

11. Apparatus of claim 9 or 10,
wherein said processor is configured to determine an individual group parametric un-mixing matrix $\mathbf{U}_k$ for each group of downmix signals based on the individual downmixing matrix $\mathbf{D}_k$, the individual group covariance matrix $\mathbf{E}_k$, and the individual regularized inverse group matrix $\mathbf{J}_k$, and
wherein said combiner is configured to combine the an individual group parametric un-mixing matrix $\mathbf{U}_k$ to obtain an overall group parametric un-mixing matrix $\mathbf{U}$.

12. Apparatus of claim 11,

wherein said processor is configured to determine an individual group parametric un-mixing matrix $\mathbf{U}_k$ for each group of downmix signals based on the individual downmixing matrix $\mathbf{D}_k$, the individual group covariance matrix $\mathbf{E}_k$, and the individual regularized inverse group matrix $\mathbf{J}_k$, and

wherein said combiner is configured to combine the individual group parametric un-mixing matrix $\mathbf{U}_k$ to obtain an overall group parametric un-mixing matrix $\mathbf{U}$.

13. Apparatus of any of claims 1 to 12,

wherein said processor is configured to determine an individual group rendering matrix $\mathbf{R}_k$ for each group of downmix signals.

14. Apparatus of claim 13,

wherein said processor is configured to determine an individual upmixing matrix $\mathbf{R}_k\mathbf{U}_k$ for each group of downmix signals based on the individual group rendering matrix $\mathbf{R}_k$ and the individual group parametric un-mixing matrix $\mathbf{U}_k$, and

wherein said combiner is configured to combine the individual upmixing matrices $\mathbf{R}_k\mathbf{U}_k$ to obtain an overall upmixing matrix $\mathbf{RU}$.

15. Apparatus of claim 13 or 14,

wherein said processor is configured to determine an individual group covariance matrix $\mathbf{C}_k$ for each group of downmix signals based on the individual group rendering matrix $\mathbf{R}_k$ and the individual group covariance matrix $\mathbf{E}_k$, and

wherein said combiner is configured to combine the individual group covariance matrices $\mathbf{C}_k$ to obtain an overall group covariance matrix $\mathbf{C}$.

16. Apparatus of any of claims 13 to 15,

wherein said processor is configured to determine an individual group covariance matrix of the parametrically estimated signal $(\mathbf{E}_y^{dry})_k$ based on the individual group rendering matrix $\mathbf{R}_k$, the individual group parametric un-mixing matrix $\mathbf{U}_k$, the individual downmixing matrix $\mathbf{D}_k$, and the individual group covariance matrix $\mathbf{E}_k$,and

wherein said combiner is configured to combine the individual group covariance matrices of the parametrically estimated signal $(\mathbf{E}_y^{dry})_k$ to obtain an overall parametrically estimated signal $\mathbf{E}_y^{dry}$.

17. Apparatus of any of claims 1 to 16,

wherein said processor is configured to determine a regularized inverse matrix **J** based on a singular value decomposition of a downmix covariance matrix $\mathbf{E}_{DMX}$.

18. Apparatus of any of claims 1 to 17,
wherein said processor is configured to determine for a determination of a parametric un-mixing matrix **U** sub-matrix $\mathbf{\Delta}_k$ by selecting elements **Δ** (m, n) corresponding to the downmix signals m, n assigned to the respective group k of downmix signals.

19. Apparatus of any of the preceding claims,
wherein said combiner is configured to determine a post-mixing matrix **P** based on the individually determined matrices for each group of downmix signals and
wherein said combiner is configured to apply the post-mixing matrix **P** to the plurality of downmix signals in order to obtain the decoded audio signal.

20. Method for processing an encoded audio signal comprising a plurality of downmix signals associated with a plurality of input audio objects and object parameters **E**, said method comprises:
grouping said downmix signals into a plurality of groups of downmix signals based on information within said encoded audio signal, wherein each group of downmix signals is associated with a set of input audio objects of said plurality of input audio objects,
performing at least one processing step individually on the object parameters $\mathbf{E}_k$ of each set of input audio objects in order to provide group results, and
combining said group resultsin order to provide a decoded audio signal,
wherein grouping said plurality of downmix signals into said plurality of groups of downmix signals so that each input audio object of said plurality of input audio objects belongs to just one set of input audio objects, and
wherein grouping said plurality of downmix signals into said plurality of groups of downmix signals so that each input audio object of each set of input audio objects either is free from a relation signaled in the encoded audio signal with other input audio objects or has a relation signaled in the encoded audio signal only with at least one input audio object belonging to the same set of input audio objects.