

What is claimed is:

CLAIMS

- 5 1. An audio encoding method comprising:
- receiving, with at least one processor, an input multi-channel audio signal comprising a primary input audio channel and L non-primary input audio channels;
- determining, with the at least one processor, a set of L input gains, where L is a positive integer greater than one;
- 10 for each of the L non-primary input audio channels and L input gains, forming a respective scaled non-primary input audio channel from the respective non-primary input audio channel scaled according to the input gain;
- forming a primary output audio channel from the sum of the primary input audio channel and the scaled non-primary input audio channels;
- 15 determining, with the at least one processor, a set of L prediction gains:
- for each of the L prediction gains, forming, with the at least one processor, a prediction channel from the primary output audio channel scaled according to the prediction gain;
- forming, with the at least one processor, L non-primary output audio channels from the difference of the respective non-primary input audio channel and the respective prediction signal;
- 20 forming, with the at least one processor, an output multi-channel audio signal from the primary output audio channel and the L non-primary output audio channels;
- encoding, with an audio encoder, the output multi-channel audio signal; and
- 25 transmitting or storing, with the at least one processor, the encoded output multi-channel audio signal.
2. The method of claim 1, wherein determining the set of L input gains, comprises:
- determining a set of L mixing coefficients;
- 30 determining an input mixture strength coefficient; and
- determining the L input gains by scaling the L mixing coefficients by the input mixture strength coefficient.

3. The method of claim 2, wherein determining the set of L prediction gains, comprises:
 - determining a set of L mixing coefficients;
 - determining a prediction mixture strength coefficient; and
 - determining the L prediction gains by scaling the L mixing coefficients by the
- 5 prediction mixture strength coefficient.

4. The method of claim 3, wherein the input mixture strength coefficient, h , is determined by a pre-prediction constraint equation, $h=f/g$, where f is a pre-determined constant value greater than zero and less than or equal to one, and g is the prediction mixture strength coefficient.
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5. The method of claim 4, wherein the prediction mixture strength coefficient, g , is a largest real value solution to: $\beta f^2 g^3 + 2\alpha f g^2 - \beta f g - \alpha + g w = 0$, where $\beta = u^H \times E \times u$, $u = \frac{1}{\alpha} v$, $\alpha = |v|_2 = \sqrt{\sum_{n=1}^N v_n^2}$, and quantity w , column vector v and matrix E are components of a covariance matrix for an intermediate signal that has a dominant channel.
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6. The method of claim 5, wherein the covariance matrix of the intermediate signal is computed from a covariance matrix of the multi-channel input audio signal.

7. The method of claims 2 or 3 wherein two or more input multi-channel audio channels are
- 20 processed according to a mixing matrix to produce the primary input audio channel and the L non-primary input audio channels.

8. The method of claim 7, wherein the primary input audio channel is determined by a dominant eigen-vector of an expected covariance of a typical input multi-channel audio signal.
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9. The method of claims 2 or 3, wherein each of the L mixing coefficients are determined based on a correlation of a respective one of the non-primary input audio channels and the primary input audio channel.

10. The method of claim 1, wherein the encoding includes allocating more bits to the primary output audio channel than to the L non-primary output audio channels, or discarding
- 30 one or more of the L non-primary output audio channels.

11. A system comprising:
 - one or more computer processors; and

a non-transitory computer-readable medium storing instructions that, when executed by the one or more computer processors, cause the one or more computer processors to perform operations comprising of any of claims 1-10.

- 5 12. A non-transitory computer-readable medium storing instructions that, when executed by one or more computer processors, cause the one or more computer processors to perform operations comprising of any of claims 1-10.