## CLAIMS

1. A method (500) comprising:

generating (502), at a speech encoder, a high-band residual signal (224) based on a high-band portion (124) of an audio signal;

generating (504) a harmonically extended signal (208) at least partially based on a low-band portion of the audio signal (144);

determining (506) a mixing factor based on the high-band residual signal, the harmonically extended signal, and modulated noise (220), wherein the modulated noise is at least partially based on the harmonically extended signal (208) and white noise (205); and

generating a high-band excitation signal (161) based on combining a first signal corresponding to the harmonically extended signal (208) scaled based on the mixing factor and a second signal corresponding to the modulated noise (220) scaled based on the mixing factor.

2. The method of claim 1, wherein the mixing factor is adjusted using a closed-loop analysis, wherein adjusting the mixing factor using the closed-loop analysis comprises:

comparing the high-band residual signal to a high-band excitation signal;

generating an error signal based on the comparison; and

adjusting the mixing factor based on the error signal.

3. The method of claim 1, wherein the mixing factor is adjusted based on a mean square error of a difference between the high-band residual signal and the high-band excitation signal.

4. The method of claim 3, wherein the mixing factor is further adjusted based on low band voicing, low band tilt, or any combination thereof.

5. The method of claim 3, further comprising:

selectively incrementing or decrementing a first mixing factor to generate a second mixing factor; and

wherein the mixing factor corresponds to the first mixing factor in response to a determination that the mean square error based on the first mixing factor is less than the mean square error based on the second mixing factor, and

wherein the mixing factor corresponds to the second mixing factor in response to a determination that the mean square error based on the second mixing factor is less than the mean square error based on the first mixing factor.

6. The method of claim 1, further comprising transmitting the mixing factor to a receiver as part of a bitstream.

7. An apparatus comprising:

a linear prediction analysis filter (204) to generate a high-band residual signal (224) based on a high-band portion (124) of an audio signal;

a non-linear transformation generator (207) to generate a harmonically extended signal (208) at least partially based on a low-band portion of the audio signal (144);

a mixing factor calculator (212) to determine a mixing factor based on the high-band residual signal, the harmonically extended signal, and modulated noise (220), wherein the modulated noise is at least partially based on the harmonically extended signal (208) and white noise (205); and

a high-band excitation generator (302) to generate a high-band excitation signal (161), the high-band excitation generator including a mixer (211) to combine a first signal corresponding to the harmonically extended signal scaled based on the mixing factor and a second signal corresponding to the modulated noise scaled based on the mixing factor.

8. The apparatus of claim 7, wherein the mixing factor is adjusted using a closed-loop analysis and the apparatus further comprises an error detection circuit (306) and an error minimization calculator (308) to adjust the mixing factor using the closed-loop analysis;

wherein the error detection circuit is configured to compare the high-band residual signal (224) to a high-band excitation signal (161); and

wherein the error minimization calculator is configured to:

generate an error signal based on the comparison; and

adjust the mixing factor based on the error signal.

9. The apparatus of claim of claim 7, wherein the mixing factor is adjusted based on a mean square error of a difference between the high-band residual signal and the high-band excitation signal and the apparatus further comprises an error controller configured to:

selectively increment or decrement a first mixing factor to generate a second mixing factor; and

wherein the mixing factor corresponds to the first mixing factor in response to a determination that the mean square error based on the first mixing factor is less than the mean square error based on the second mixing factor, and

wherein the mixing factor corresponds to the second mixing factor in response to a determination that the mean square error based on the second mixing factor is less than the mean square error based on the first mixing factor.

10. The apparatus of claim 7, further comprising a transmitter to transmit the mixing factor to a receiver as part of a bitstream.

11. A method (510) comprising:

receiving (512), at a speech decoder, an encoded signal including a low-band excitation signal and high-band side information,

wherein the high-band side information includes a mixing factor, and

wherein the mixing factor is based on a high-band residual signal, a first harmonically extended signal, and first modulated noise; and

generating (514) a high-band excitation signal by mixing a first signal corresponding to a second harmonically extended signal and a second signal corresponding to second modulated noise, wherein the second harmonically extended signal is scaled based on the mixing factor, and wherein the second modulated noise is scaled based on the mixing factor.

12. An apparatus comprising a speech decoder configured to:

receive an encoded signal including a low-band excitation signal and high-band side information,

wherein the high-band side information includes a mixing factor, and

wherein the mixing factor is based on a high-band residual signal, a first harmonically extended signal, and first modulated noise; and

generate a high-band excitation signal by mixing a first signal corresponding to a second harmonically extended signal and a second signal corresponding to second modulated noise, wherein the second harmonically extended signal is scaled based on the mixing factor, and wherein the second modulated noise is scaled based on the mixing factor.

13. A non-transitory computer readable medium comprising instructions that, when executed by a processor at a speech decoder, causes the processor to carry out a method according to any of claims 1 to 6 and 11.