CLAIMS

What is claimed is:

1. A method of audio processing, the method comprising:

generating a plurality of modified impulse responses from a plurality of original impulse responses, wherein the plurality of original impulse responses respectively correspond to a plurality of frequencies, wherein generating the plurality of modified impulse responses includes:

generating a pre-ripple response based on a first original impulse response;

generating a post-ripple response based on the pre-ripple response;

adding the post-ripple response to the first original impulse response, and subtracting the pre-ripple response from the first original impulse response, to generate a first modified impulse response; and

filtering an input signal with the plurality of modified impulse responses to generate an output signal.

2. The method of claim 1, wherein generating the pre-ripple response comprises:

performing a fade operation on the first original impulse response to generate the pre-ripple response.

3. The method of claim 2, wherein generating the post-ripple response comprises:

performing a time reverse operation on the pre-ripple response to generate the post-ripple response.

4. The method of claim 1, wherein generating the plurality of modified impulse responses includes:

generating a first filter response based on a first original impulse response;

generating a pre-ripple response based on the first filter response;

generating an intermediate response based on the pre-ripple response;

generating a second filter response based on the intermediate response;

generating a post-ripple response based on the second filter response; and

adding the first filter response, adding the post-ripple response, and subtracting the pre-ripple response to generate a first modified impulse response.

5. The method of claim 4, wherein generating the first filter response comprises:

performing a first all-pass filter operation on the first original impulse response to generate the first filter response.

6. The method of claim 5, wherein the first all-pass filter operation applies a transfer function G_{ap} to the first original impulse response, wherein

$$G_{ap} = \frac{0.994986 - 1.000000z^{-1}}{1.000000 - 0.994986z^{-1}}$$

7. The method of any one of claims 5-6, wherein the first all-pass filter operation is a first-order filter with a single real pole between 10Hz and 200Hz.

8. The method of any one of claims 5-7, wherein the first all-pass filter operation has a latency of L samples of an audio signal sampled at a rate of F_s samples per second, and wherein a frequency f of a pole of the all-pass filter operation is calculated according to an equation

$$f = \frac{F_s}{12L}\text{Hz}$$

9. The method of any one of claims 4-8, wherein generating the pre-ripple response comprises:

performing the fade operation on the first filter response to generate the pre-ripple response.

2. The method of any one of claims 4-9, wherein generating the intermediate response comprises:

performing the time reverse operation on the pre-ripple response to generate the intermediate response.

11. The method of any one of claims 4-10, wherein generating the second filter response comprises:

performing a second all-pass filter operation on the intermediate response to generate the second filter response.

12. The method of any one of claims 4-11, wherein generating the post-ripple response comprises:

performing a third all-pass filter operation on the second filter response to generate the post-ripple response.

13. The method of any one of claims 1-12, further comprising:

generating a plurality of weighted modified impulse responses by applying a plurality of weights to the plurality of modified impulse responses,

wherein filtering the input signal comprises filtering the input signal with the plurality of weighted modified impulse responses to generate the output signal.

14. The method of claim 13, wherein a reconstruction impulse response corresponds to a sum of the weighted modified impulse responses, where the group delay of the reconstruction impulse response is approximately constant for frequencies above 500Hz.

15. The method of claim 14, wherein a bandwidth of at least one of the plurality of weighted modified impulse responses is narrower according to an increased group delay of the reconstruction impulse response.

16. The method of any one of claims 13-15, wherein the plurality of weights are time varying.

17. The method of any one of claims 1-16, wherein the input signal is one of a plurality of input signals, wherein the plurality of modified impulse responses are applied by a plurality of filter banks, wherein the output signal is one of a plurality of output signals, and wherein a given filter bank filters a given input signal to generate a given output signal.

18. A non-transitory computer readable medium storing a computer program that, when executed by a processor, controls an apparatus to execute processing including the method of any one of claims 1-17.

19. An apparatus for audio processing, the apparatus comprising:

a processor; and

a memory,

wherein the processor is configured to control the apparatus to generate a plurality of modified impulse responses from a plurality of original impulse responses, wherein the plurality of original impulse responses respectively correspond to a plurality of frequencies, wherein generating the plurality of modified impulse responses includes:

generating a pre-ripple response based on a first original impulse response;

generating a post-ripple response based on the pre-ripple response;

adding the post-ripple response to the first original impulse response, and subtracting the pre-ripple response from the first original impulse response, to generate a first modified impulse response; and

wherein the processor is configured to control the apparatus to filter an input signal with the plurality of modified impulse responses to generate an output signal.