[0006a] An aspect of the present invention provides a system for enhancing the low frequency response of a loudspeaker for relatively low input level audio signals and protecting the loudspeaker for relatively high input level audio signals, the system comprising: a crossover network configured so as to separate an audio input signal into at least two frequency bands including a low frequency band; and a signal compressor responsive to the energy level of the low frequency portion of an input audio signal in the low frequency band and configured to provide amplification gain on the low frequency portion of the input signal when the energy level of the low frequency portion of the input signal is relatively low so as to enhance the low frequency response of the loudspeaker, and provide attenuation of the low frequency portion of the input signal when the energy level of the low frequency portion of the input signal is relatively high so as to protect the loudspeaker from being overdriven; wherein the system is configured to enhance the low frequency response of at least two loudspeakers for left and right channel stereo play; the crossover network is configured to separate each of a left and right channel audio input signals into at least two frequency bands including a low frequency band; and the signal compressor is responsive to the energy level of the low frequency portion of each of the left and right audio input signals in the low frequency band and configured to provide amplification gain on the low frequency portion of each of the left and right channel audio input signals when the energy level of the low frequency portion of each of the signals is relatively low so as to enhance the low frequency response of each of the loudspeakers, and provide attenuation of the low frequency portion of each of the left and right channel audio input signals when the energy level of the low frequency portion of each of the signals is relatively high so as to protect each loudspeaker from being overdriven; wherein the system further comprises a signal summer configured to provide a summed compressed signal representing the sum of the compressed output signals of the signal compressor of the left and right channels, and at least two summing blocks for providing left and right channel summed signals as a function of the summed compressed signal and the portion of each left and right channel signal provided in each remaining frequency band.

[0006b] Another aspect of the present invention provides a method of enhancing the low frequency response of at least two loudspeakers for relatively low input level audio signals and protecting the loudspeakers for relatively high input level audio signals, the method comprising: separating each of a right and a left audio input signal into at least two frequency bands including a low frequency band; compressing the low frequency portion of each of the right and the left input audio signals in the low frequency band so as to provide amplification gain on the low frequency portion of each of the right and the left input signals when the energy level of the low frequency portion of each of the right and the left input signals is relatively low so as to enhance the low frequency response of each of the loudspeakers, and provide attenuation of the low frequency portion of each of the right and the left input signals when the energy level of the low frequency portion of each of the right and the left input signals is relatively high so as to protect each of the loudspeakers from being overdriven; and providing a summed compressed signal representing the sum of the compressed low frequency portions of the left and right signals, and providing left and right channel summed signals as a function of the summed compressed signal and the portion of each left and right input signal provided in each remaining frequency band.

[0007] There is also disclosed~~More specifically, in accordance with one aspect,~~ a system ~~is provided~~ for enhancing the low frequency response of a loudspeaker for relatively low input level audio signals and protect the loudspeaker for relatively high input level audio signals. The system comprises: a crossover network configured so as to separate an audio input signal into at least two frequency bands including a low frequency band; and a signal compressor responsive to the energy level of the low frequency portion of an input audio signal in the low frequency band and configured to provide amplification gain on the low frequency portion of the input signal when the energy level of the low frequency portion of the input signal is relatively low so as to enhance the low frequency response of the loudspeaker, and attenuation of the low frequency portion of the input signal when the energy level of the low frequency portion of the input signal is relatively high so as to protect the loudspeaker from being overdriven.

[0008] In accordance with the disclosure~~other aspects~~, the crossover network is configured to separate the audio signal into two frequency bands, wherein parameters of the system are configurable to optimize for a given speaker characteristic or listener preference. The configurable parameters include one or more of the following: crossover frequency, compression ratio, maximum allowable gain, high pass filter cutoff frequency, and target level. In one ~~embodiment~~example, the compressor includes an RMS based level detector for generating a signal representing the energy level of the low frequency portion of the input audio signal. In accordance with another ~~embodiment~~example, a summing block is provided so as to provide a summed signal as a function of the compressed output of the signal compressor signal provided in each remaining frequency band. A high pass filter can be configured to respond to the summed signal and limit the lowest frequency energy applied to the loudspeaker. Further, a peak limiter can be configured to respond to the summed signal and limit the maximum peak level of signal energy applied to loudspeaker. It should be obvious that the peak limiter could also be placed,

in the low band, before the summer and respond to the compressor output. The system can further include a static equalizer configured to respond to the summed signal, the static equalizer including a lower limit greater than or *equal to the crossover frequency of the cross over network so that the static* equalizer, combined with the compressor, operates as a partially dynamic equalizer. In accordance with one ~~embodiment~~example, the system is configured to enhance the low frequency response of at least two loudspeakers for left and right channel stereo play, the crossover network is configured to separate each left and right channel audio input signals into at least two frequency bands including a low frequency band; and the signal compressor is responsive to the energy level of the low frequency portion of each of the left and right audio input signals in the low frequency band and configured to provide amplification gain on the low frequency portion of each of the left and right channel audio input signals when the energy level of the low frequency portion of each of the signals is relatively low so as to enhance the low frequency response of each of the loudspeakers, and provide attenuation of the low frequency portion of each of the left and right channel audio input signals when the energy level of the low frequency portion of each of the signals is relatively high so as to protect each loudspeaker from being overdriven. Finally, in accordance with another ~~embodiment~~example, the system can include a pair of summing blocks for providing a pair of summed signals as a function of the compressed output signal of the signal compressor of the left channel and the corresponding signals of remaining frequency bands of the left channel, and the compressed output signal of the signal compressor of the right channel and the corresponding signals of the remaining bands of the right channel. The system can further include a signal summer configured to provide a summed compressed signal representing the sum of the compressed output signals of the signal compressor of the left and right channels, and at least two summing blocks for providing left and right channel summed signals as a function of the summed compressed signal and the

portion of each left and right channel signal provided in each remaining frequency band.

[0009] There is also disclosed~~In accordance with another aspect,~~ a two-band compressor based architecture for use with a loudspeaker ~~is provided~~. The architecture is configurable as a volume leveler, bass enhancer and speaker protection device.

[0010] There is also disclosed~~In accordance with another aspect,~~ a method of enhancing the low frequency response of a loudspeaker ~~is provided~~ for relatively low input level audio signals and protecting the loudspeaker for relatively high input level audio signals. The method comprises: separating an audio input signal into at least two frequency bands including a low frequency band; and compressing the low frequency portion of an input audio signal in the low frequency band so as to provide amplification gain on the low frequency portion of the input signal when the energy level of the low frequency portion of the input signal is relatively low so as to enhance the low frequency response of the loudspeaker, and provide attenuation of the low frequency portion of the input signal when the energy level of the low frequency portion of the input signal is relatively high so as to protect the loudspeaker from being overdriven.

[0011] These, as well as other components, steps, features, objects, benefits, and advantages, will now become clear from a review of the following detailed description of illustrative embodiments, the accompanying drawings, and the claims.

BRIEF DESCRIPTION OF DRAWINGS

[0012] The drawings disclose illustrative embodiments. They do not set forth all embodiments. Other embodiments may be used in addition or instead. Details which may be apparent or unnecessary may be omitted to