AUDIO ENHANCEMENT

taking audio into a new dimension

OVERVIEW

AM3D Audio Enhancement is a world-class digital signal processing solution capable of enhancing the audio on mobile devices, TVs, and other devices where audio is an essential part of the user experience. The solution is purely software-based and is easily integrated into existing software platforms. All features have very low memory and computational power usage.

The physical nature of small devices or industrial design restricted devices means that listening conditions often differ greatly from those preferred by the creators of the original media source. For example, stereo music and multi-channel audio are produced with specific loudspeaker arrangements in mind, and these are not directly achievable in small devices nor in headphones. Other limitations may also be caused by low acoustic output power and reduced bandwidth capability.

To overcome the inherent audio performance limitations of such devices, AM3D Audio Enhancement offers state-of-the-art audio enhancement technologies for speaker playback optimisation and applying spatial audio effects, many of which are patented by AM3D. Whether audio is played back on headphones or loudspeakers, the AM3D Audio Enhancement significantly increases the perceived quality of the audio playback by adding high-quality features: 1) to increase and balance the bandwidth of the speaker by equalising its efficient region and boosting the lower and upper frequency regions, 2) to boost and align the output level, 3) to create a perceived widened or surrounding audio image - being outside the head in headphones.

In addition to the AM3D Audio Enhancement software, AM3D offers tuning and filter design tools for quick and easy adaption of the software to each device model.

AM3D Audio Enhancement offers the following features:

- Mono/Stereo Widening
- Virtual Surround Sound
- Transducer Equalization*
- Bass, Treble and Level Enhancement*
- Level Alignment

**) Designed for electro-magnetic speakers e.g. micro-speakers, loudspeakers and headphones.*

Please find more details on the other side of this hand-out.

INTEGRATION

The AM3D Audio Enhancement product is based on digital signal processing algorithms implemented in software. A software solution can be delivered for general-purpose computers, embedded systems and dedicated DSP platforms.

A conceptual block diagram of how the AM3D Audio Enhancement software is integrated into a typical embedded system is illustrated in the figure below.

The AM3D Audio Enhancement software is generic, module-based and configurable. The solution is not dependent on any external libraries, e.g. open source code, and is developed in ANSI C using assembly-optimised coding for the resource-intense parts targeted at various platforms. An entire ANSI C reference solution is available for fast prototyping on any customer device. Optimised software is already available for a number of platforms (e.g. ARM, Renesas SH and CSR Bluecore) and can within short time be optimised for or ported to other dedicated platforms.

ABOUT AM3D

AM3D is a provider of world-class audio technology providing software solutions for audio enhancement and 3D audio for mobile phones and portable devices, in-car and home entertainment systems, and for mission-critical applications. AM3D holds several patents on audio technologies.

AM3D has offices in Denmark (Aalborg), Japan (Tokyo) and South Korea (Seoul). AM3D is owned by Nordjyske Holding A/S which has more than 1,000 employees and a history that dates back to 1767. AM3D A/S was established in 2003 as a commercial offspring of research activities at Aalborg University in Denmark.

FEATURES

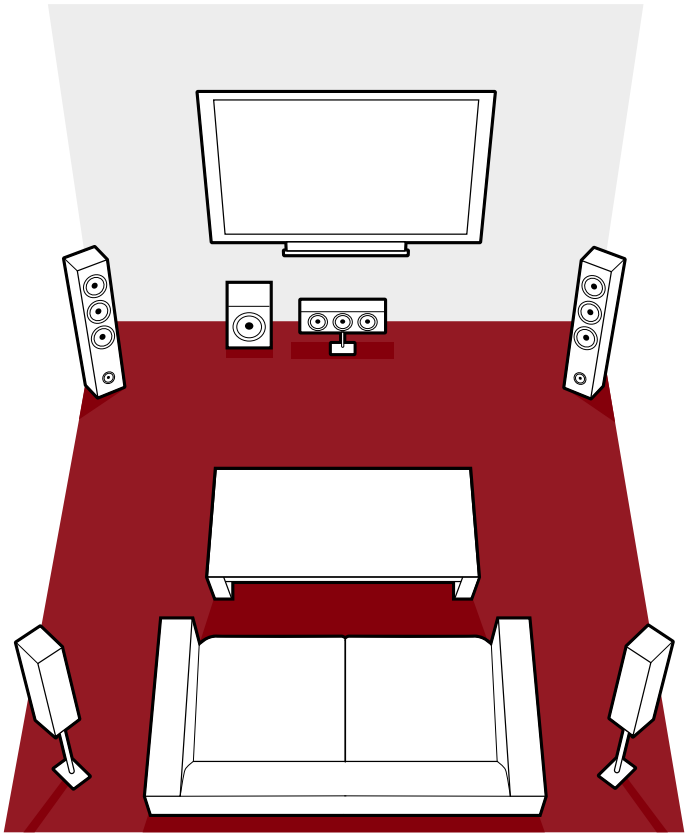
AM3D Mono Widening When a monophonic audio signal is presented to a listener through stereo headphones, the sound image will be perceived as being inside the head. AM3D Mono Widening moves the sound image to a position outside the head within a natural listening environment. This gives an enhanced feeling of comfort and relief during use and brings the listener closer to a natural listening situation.

AM3D Stereo Widening In typical portable devices with stereo micro-speakers, transducers are placed close together. When listening to music through the speakers, the stereo sound stage is very narrow. AM3D Stereo Widening creates virtual sound sources that are perceived to be placed beyond the extent of the physical device. As a result, a much wider and more natural sound image is perceived.

Normal headphone playback is often perceived as playing inside the head. With AM3D Stereo Widening for headphones, the user perceives the sound image as being much wider and outside the head, which improves the overall listening experience.

AM3D Virtual Surround Sound The introduction of video and multi-channel audio streaming in small devices is driving the need for producing surround sound on headphones as well as narrow spaced stereo loudspeakers.

AM3D Virtual Surround Sound enables the experience of surround sound with a 5.1/7.1 multi-channel audio input signal. AM3D Virtual Surround Sound creates the illusion that the sound is coming from loudspeakers placed in a 5.1/7.1 surround loudspeaker set-up. This is based on binaural processing patented Head-Related Transfer Functions (HRTFs).



If a multi-channel surround signal is not available, AM3D Virtual Surround Sound can also convert a two channel stereo signal to a binaural signal which, when played back, produces a virtual surround sound experience similar to that of a multi-channel surround sound input signal. The signal processing effectively tricks the ear into experiencing sounds as coming from various directions, while voices are kept at the centre.

AM3D Virtual Surround Sound is with headphones perceived as being outside the head with a clear and distant frontal sound image – opposite to normal headphone listening where the sound is perceived as being inside the head.

AM3D Transducer Equalization Often speakers especially in small devices and headphones do not have an ideal frequency response, e.g. some frequencies are reproduced louder than intended due to resonances of the acoustic system. AM3D Transducer Equalization compensates for this by equalizing the response to achieve a specific target. The AM3D Transducer Equalization is a vital component to optimise the speaker playback, and the overall perceive sound quality will be improved significantly by use hereof.

AM3D Bass Enhancement Loudspeakers which reproduce sound in the mid and high-frequency range are generally poor at reproducing low-frequency sounds. Bass content is vital to movie effects and quality music to achieve a perceived high sound quality. AM3D Bass Enhancement boosts the low frequency part of the signal and leaves the remaining part of the frequency range unchanged in terms of loudness and timbre. This gives the possibility to create extreme bass enhancement.

The AM3D Bass Enhancement consists of two dedicated solutions: A generic solution optimised for mid-range loudspeakers and headphone, and one optimised specifically for micro-speakers used in, e.g., mobile phones.

AM3D Treble Enhancement Loudspeakers which reproduce sound in the low to mid-frequency range are generally poor at reproducing high frequency sounds. A common approach in playback systems is to use a second loudspeaker (tweeter) for reproducing the high frequencies. AM3D Treble Enhancement approaches this problem differently by boosting the high frequency content of an audio signal. As a result, AM3D Treble Enhancement provides a clear and crisp treble which emphasises details that are usually lost during playback.

AM3D Level Enhancement Small loudspeaker systems are typically incapable of producing a sufficient high sound pressure level. A higher sound level is typically perceived as being of higher sound quality, thus it is vital to produce enough sound pressure level in the loudspeaker system. AM3D Level Enhancement approaches this problem by boosting the level of the audio signal beyond what would be possible with a linear gain, hence a much higher perceived sound level can be achieved in small loudspeakers systems.

AM3D Level Alignment AM3D Level Alignment adjusts the level of different audio signals to compensate for differences in loudness. This is useful e.g. when two consecutive music pieces have very different loudness. This can be songs recorded at different levels, because passages in a piece of classical music have very different levels, or because the level of advertisements on the radio is much louder than the music being played. In such cases, AM3D Level Alignment effectively aligns the signal loudness to minimise the difference.