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ShakEQ™ - Groundbreaking Innovation for Bass Shakers

Tampere, Finland, 20th of December 2024 - *DSP*eaker, an expert in automatic room correction, announces a new innovation for bass shaker systems. The new product, ShakEQ™, creates a signal optimized for tactile transducers practically from any audio content. It raises the listening experience of home theaters to a new level. The use of ShakEQ™ with a seat shaker and headphones provides a significant improvement for video games. The first part of the paper summarizes the existing challenges in each market segment, as well as the main problems related to the use of tactile transducers. The second part describes what ShakEQ™ can contribute.

Statement of the problem

In the last two decades, the development of the audio device segment has split into three main business categories: music, movies and games.

From these three, listening to music has experienced the biggest change since the invention of mp3 players. The majority of people are nowadays using mobile devices together with wireless earphones or headphones. One downside with headphones is that they do not provide the feeling of base resonances over the body bones like speakers do. Therefore, the most natural listening experience is still achieved by using classical stereo high-end speakers possibly accompanied with subwoofers.

For a long time, the home theater development has been on a “more is better” track: more channels, speakers, subwoofers, bits and samples. These improvements may provide more fun for audio tweaking, but do not necessarily improve the audio experience. The acoustics of a room usually play the most important role when using speakers. In most domestic environments the low-frequency audio content is difficult to produce accurately.

The gaming market relies much on headphone development for music, focusing on low latency, good spatial resolution, and clear hands-free communication by using an integrated microphone. Gaming headphones suffer the same problem as wireless headphones. They lack the feeling of sound pressure over the body bones in low frequencies. Small tactile transducers which are often integrated into game controllers, provide some improvement, especially when their control is integrated in the game. But they still leave a lot of room for improvement.

Bass shakers have existed for more than a decade to generate low-frequency vibration directly to material instead of through air movement. A bass shaker is like a big subwoofer element, but without a diaphragm. Instead, its output is directly connected to the material. There are many bass shakers on the market, but the real impact comes with the biggest ones. These are capable of driving heavy loads, such as chairs and couches.

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Bass shakers take the input from an audio source, such as L+R or SUB. The soundtracks are made for speakers, not bass shakers. The biggest and fundamental problem when using bass shakers is that the audio source has no separate track to control them. Using a signal from an existing audio output leads to over or under statements of the bass shaker.

The transfer function from the electrical input of the bass shaker to the listener's body is complex. It is affected by the mounting location of the shaker. The strongest vibrations are usually achieved in mounting positions that also create unwanted resonances. The cushion of the sofa and the listener's body are also part of the transfer function. The market is missing a consumer-level tool to control the resonances of a shaker system.

A powerful bass shaker has a piston which is constructed of a heavy-gauge coil wire and surrounded by a large metal housing. The starting friction and limited acceleration and de-acceleration time of the piston as well as the self inductance of the coil limit the dynamic range of the shaker. This means that the user may not sense the vibrations below a certain level of the audio signal.

The invention - ShakEQ™

*DSP*eaker introduces a groundbreaking invention that significantly improves the performance of any bass shaker installation.

The ShakEQ™ device is easy to add to the audio system. It has dual RCA inputs and outputs and it is connected between the audio source and the shaker amplifier.

The initial use of ShakEQ™ starts by entering the calibration mode. The user sits on a sensor plate that is placed between the vibrating surface (such as a sofa cushion) and the gluteus muscle. ShakEQ™ then scans low frequencies and measures the system's total response at the listening position. The device then optimizes the filter coefficients to minimize the unwanted resonances. The shaker system response can further be exported to a USB stick and the user may visualize the optimization for example in Room EQ Wizard (REW). The sensor plate will be removed after the initial setting and it is not used in a normal operation.

A bass shaker's heavy mass leads to a reduction in its dynamic range. To overcome this feature, the incoming signal could be compressed to match the available dynamic range of the bass shaker. Such an approach improves the system response with low signal levels, but unfortunately also smooths high-level signal transients (such as gunshot). ShakEQ has a **dynamic range optimizer**, a sophisticated compressor that increases the feeling of low-level sounds without affecting the transient response of loud sounds. It has three predefined general presets (music, movie, game) and each with adjustable effect levels. The product also supports customizable user presets.

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Since audio signals (including multi-channel sources) do not have a designated track for shakers, the shaker may suffer silence over long periods. This happens specifically when the soundtrack's content is not rich enough to provide natural vibration. ShakEQ™ has a **bass extender**, an adjustable frequency shifter to convert some mid-bass audio energy down to sweet spot frequencies that are easily felt with bass shakers. The result is a significant improvement of immersion.

ShakEQ™ provides much freedom to mount the tactile transducer. It allows the user to take the most powerful shaker, mount it by maximizing the vibrations to the user’s body and at the same time ignore all possible distortions. ShakEQ™ then linearizes the response and eliminates the resonances. The optimization also works in multiple-shaker configurations. The ShakEQ™ has dynamic range optimizer and bass extender technologies to personalize the essential information from any audio source specifically for the shaker. It enormously improves realism when using headphones or when the room size limits the capability of the subwoofer.

DSPeaker is demonstrating ShakEQ at CES 2025. Please visit our booth #16152.

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*DSP*eaker has decades of expertise in automatic room correction. *DSP*eaker’s Anti-Mode™ technology for subwoofers has been honored with many rewards, including the Golden Ear award from the Absolute Sound magazine. ShakEQ™ is *DSP*eaker’s new market segment for tactile transducers and it benefits from the pre-existing work of the Anti-Mode™ technology. Five years of intensive research and development has preceded the release of the first ShakEQ™ product.

https://www.dspeaker.com/