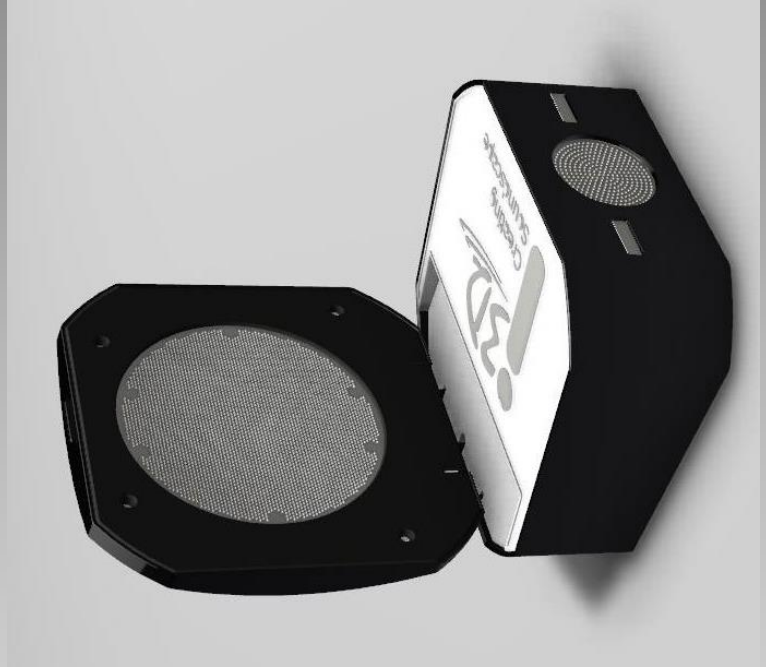


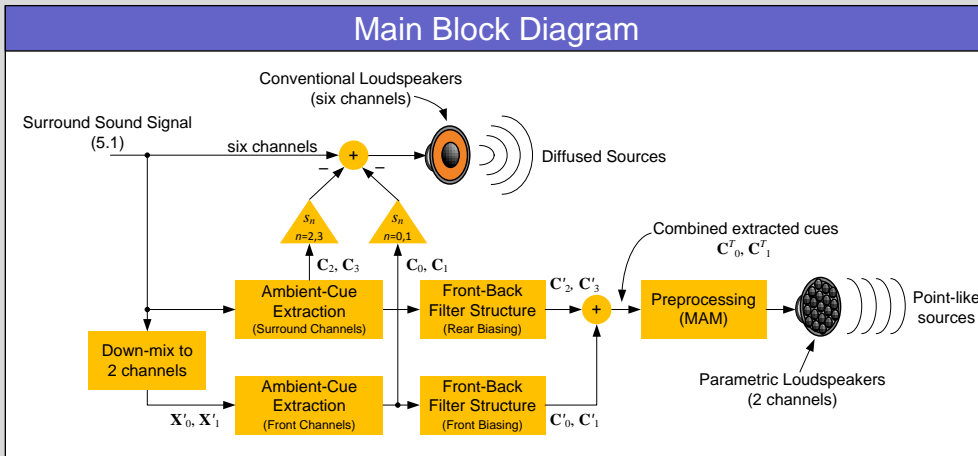
Immersive 3D (i3D) Sound System

Ee-Leng Tan, Woon Seng Gan



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Key Features

1. Accurate Spatial Audio Reproduction

- Intelligently channels ambience and cues to conventional and directional speakers in i3D

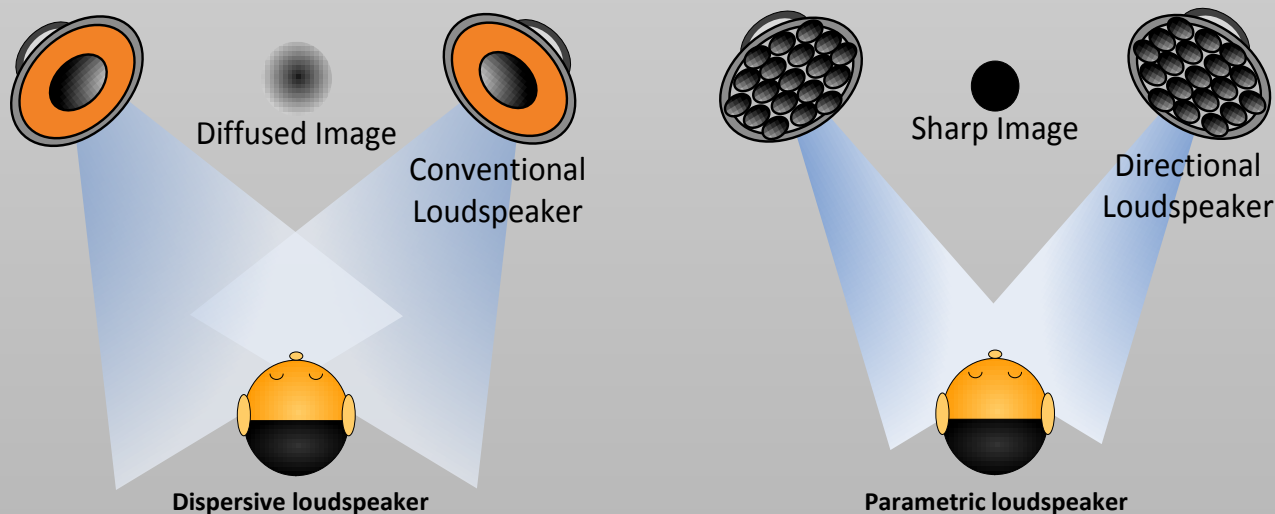
2. Compatible with Existing Sound Formats

- All existing sound formats can be used with i3D without reformatting

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Spatial sound can be well-reproduced by a combination of conventional and parametric loudspeakers which is found in i3D



Rendered audio image is generally diffused due to room reverberation

Sharp and closer auditory image can be reproduced [Holman, 2008], [Harma, 2008]

i3D Specification

Emitters used	PZT (effects) Omni directional speaker (ambience)
PZT Resonance Frequency	40 kHz
Sound Pressure Level	~80dB (PZT for 1 kHz @ 1m)
Directivity of PZT	+/- 5 degree (-6dB) far field with side lobe of -15 dB at 30 degree
Effective Distance	1-5 meters (depend on the dimension of ultrasonic emitters)
Total Harmonic Distortion	Less than 1% (for 1 kHz)
Freq. Response (effects)	1 kHz – 20 KHz
Freq. Response (Ambience)	150 Hz – 20 KHz

Contact Us

Gan Woon Seng ewsgan@ntu.edu.sg
Joseph Tan etanel@ntu.edu.sg

School of Electrical and Electronic Engineering,
Block S2, S2-B4a-03, 50 Nanyang Avenue, Nanyang
Technological University. S639798.

Immersive 3D (i3D) Sound System

Rich 3D visual content is readily available to the consumer which is largely found in 3D gaming. To create a convincing 3D environment, the gamer should be able to experience to feel a certain level of spaciousness (in a virtual forest) and the 3D sound that are matched with the 3D visual (walking through a virtual forest).

A wide range of audio products such as headphones, stereo and surround sound systems (such as 5.1 and 7.1 surround speakers) are currently available. Among these products, headphones produce the best 3D sound but it is generally uncomfortable for extended usage. Due to the close proximity to the ears, limited spaciousness can be produced using headphones. On the contrary, stereo and surround sound systems can produce spaciousness in the audio sound, but at the expense of the 3D sound. From this discussion, it is clear that none of these products are highly suited for 3D media. This impairs the overall 3D experience from 3D media such as 3D gaming and the up and coming 3D TVs.

Our expertises in directional audio and audio signal processing have led us to successful research and development of an audio system that is well suited to 3D media. This POC details the implementation of such audio system that is targeted to the desktop PC market. This audio system features a novel integration of the directional loudspeaker with stereo loudspeakers which delivers accurate 3D sound as well as the spaciousness of the audio.

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