

Figure 1: Sound Waves

From abstract we can conclude speaker angles and sound intensities of individual speakers are very much important.

Speaker angles defines how the sound is gonna reach to the listener. Like is it reflecting from any surface or the sound source is directly pointed towards the listener.

Sound is nothing but oscillations of particles (typically air) in vibrational motion, which transports energy through a medium.

Speakers push and pull surround air molecules in waves to generate a sound wave using a diaphragm. Typically, this diaphragm is in conical shape hence it oscillates the molecules in the oval field.

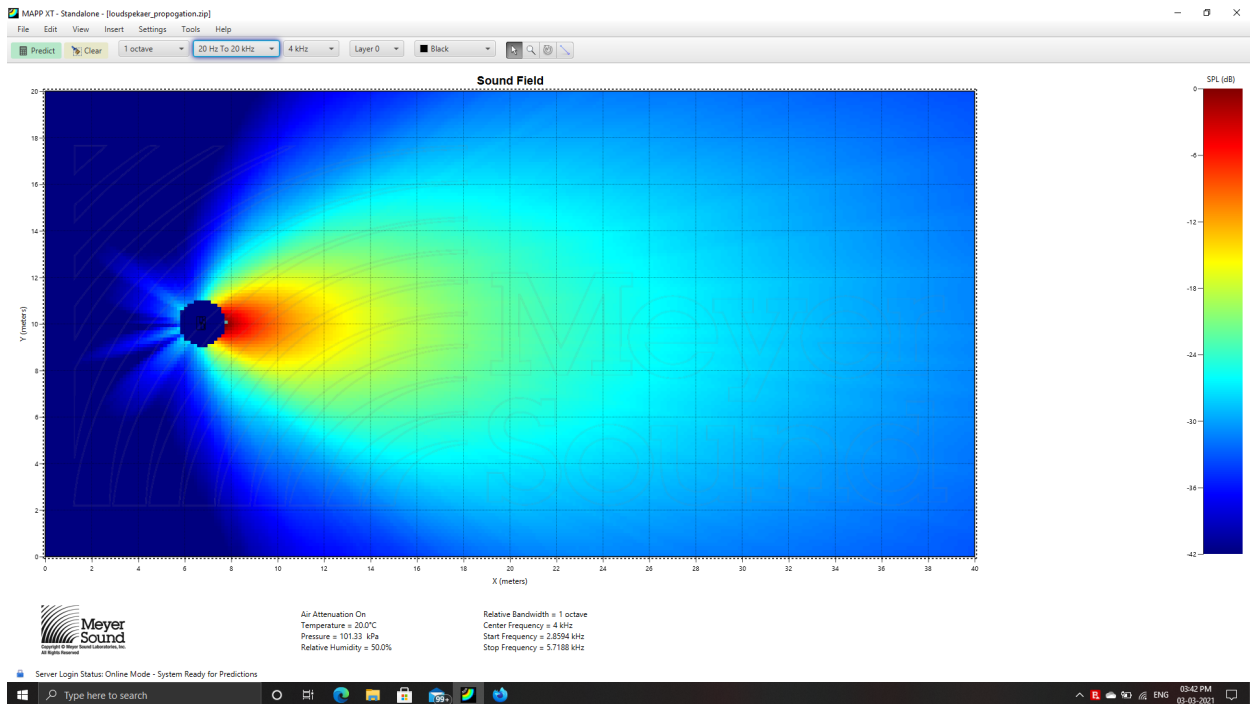


Figure 2: Sound propagation of speaker

Figure 3.2 shows the oval propagation of the sound field from the speaker. Where sound intensity of speaker at some depth is denoted with heat map (dB). In front of the speaker the sound intensity is maximum and it fades away as we go far away from the speaker. Where in the other hand it is much less at the back of the speaker. Since, it is oval in nature, the propagation to left and right is also less than that of front.

Figure 3.3 shows the reflection and reverberation of sound due to misalignment and excessive sound intensity of speaker due to collision of sound waves onto walls. These reflections build up with each reflection and decay gradually as they are absorbed by the surfaces of Objects and walls in the room. In this case, listener tends to hear direct sound and the repeated reflected sound waves which might sound muddy and grabbed.

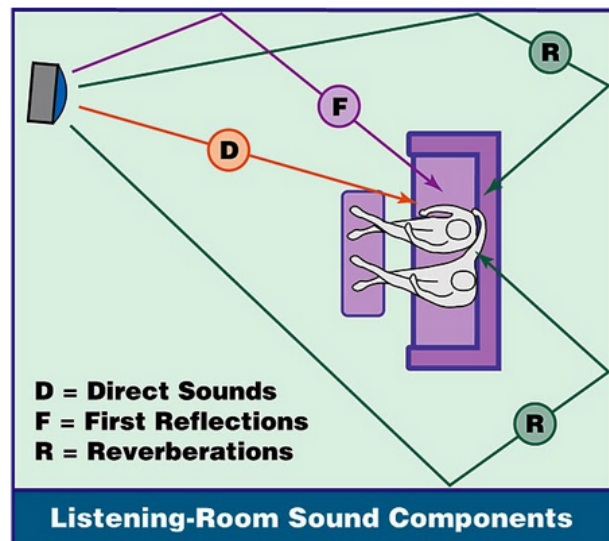


Figure 3: Reflection and reverberation of sound

Hence, it becomes necessary to align the speakers as well as adjust the sound levels in proper amounts to get best surround sound.

To overcome this scenario we experimented a five block system. Which consists of,

1. Depth estimation unit (Cameras), to measure the depth of the listener from one reference point and feed these variables to microprocessor for further calculations.
2. Microprocessor, to measure depth and calculate panning and tilting angles as well as listener's depth from each speaker.
3. Mechanical unit, to pan and tilt the speakers.
4. Audio Processor Unit (Digitally controlled amplifier), to adjust the individual speaker gain using calculated results from microprocessor.
5. Speakers, to sound individual 4 channeled output.