Course 310 - Sound System Design - Direct Field

Welcome to Sound System Design - Direct Field. You may be wondering why we made direct field a course in itself. There are some very good reasons. For one, there is a lot to establishing the direct field coverage. We have to cover and the various source types - point sources, point source arrays, line source, line arrays, how to power loudspeakers. There is a lot to it. It is a field of study. It also can be argue that the room is the room and the sound system designer has no control over the room acoustics. That is often true. We still have to consider the performance of the system as a whole including direct field and room acoustics. The direct field on its own will have excellent clarity and intelligibility. It's only when we consider room acoustics that things can go bad. Course 320 - Sound System Design - Room Acoustics will deal with speech intelligibility and sound clarity that result from providing direct field coverage to an audience. Let's dive in and look how to select and place loudspeakers to cover audiences.

Acoustic Gain

One of the first things you want to think about when you design a sound system is how much acoustic gain is needed? The acoustic gain is the level difference from and unaided talker on stage and that same talker through the sound system at the audience seat. At the drawing board, we can know how much gain is needed and if our system will provide that much gain. Oddly enough, it does not depend on amplifier size or mixer type. It depends on loudspeaker and microphone selection and placement. Where the talker is and where the listener is. Let's look how to calculate at the drawing board how much gain is needed and how to calculate rather the system will reach that amount of gain before it goes into regenerative feedback.

Four video covering these topics.

1. Introduction
2. Communication
3. Acoustic Gain
4. The Sound Reinforcement System
5. The Variables
6. Talker Level (L_{talker})
7. Listener Level (L_{listen})
8. Ambient Noise Level (L_{noise})
9. Signal-to-Noise Ratio
10. Equivalent Acoustic Distance (EAD)
11. Needed Acoustic Gain (NAG)
12. Feedback Stability Margin (FSM)
13. Number-of-Open Microphones (NOM)
14. Potential Acoustic Gain (PAG)
15. The Acoustic Gain Equation
16. What About Directivity?
17. Conclusion

The Point Source

Loudspeaker directivity makes sound reinforcement possible. The most common loudspeaker we use in our designs is the point source. What is a point source? What is the theoretical definition? What is a practicable definition? Let's dive in and look at the characteristics of these devices and how to deploy them into your designs.

Six video covering these topics.

1. Introduction
2. Sound Power
3. Sound Intensity
4. Sound Pressure
5. A Reference Case
6. Shaping the Sphere
7. Growing the Sphere
8. Loudspeaker Sensitivity
9. The Maximum Input Voltage - MIV
10. Efficiency vs. Sensitivity
11. Directivity Index and Directivity Factor
12. The Directional Point Source
13. Spherical Loudspeaker Data
14. Rated Coverage Angles
15. Directivity Summary
16. Data Presentation

Line Source

Probably one of the first things they did after the invention of the point source, is to see what would happen if you make a stack of them. So, the line array was formed. It is often said that the line arrays define the laws of physics. On the contrary. The line arrays strictly obey the laws of physics. Let's look at what constitutes a line array and what it has to give it a very useful directivity pattern.

Seven video covering these topics.

1. Wavefront Shape Overview
2. Line Arrays
3. Line Array Caveats
4. Off-Axis Response
5. Near-to-Far Field Transition
6. Line Array Length
7. Scaling the Array Length
8. Far Field Line Arrays
9. Placement and Aiming
10. Phased Arrays
11. Hybrid Arrays
12. Frequency Shading
13. CBT Arrays
14. Bessel Arrays
15. Coverage Mapping
16. Review

Audience Coverage

You can have the best loudspeaker in the world but if it doesn't cover the audience, it is not doing its job. We use to do coverage calculations with rated coverage angles and protractors. We moved far beyond that. Today we have balloon data for our loudspeakers and we have mapping programs that allow us to project this data on the flat audience planes. Listen is one of the most accurate calculations we can do at the drawing board stage of the sound system. There is no reason to leave coverage to chance. Let's look at how to get it right the first time.

Six video covering these topics.

1. Introduction
2. Coverage Mapping
3. Coverage Criteria
4. How About an Array?
5. Frequency-Dependence
6. Interference Realities
7. What About Distributed Systems?
8. Point Source Arrays
9. Tight-Packed Arrays
10. The Accidental Array
11. The Cardioid Array
12. Subwoofer Coverage

Powering Loudspeakers

Once you have the right loudspeakers in the right place, you will have to powered them. This means amplifier selection. There is probably no subject in audio dominated by more misinformation and myths than amplifier ratings and amplifier selection. But it really just comes down to basic physics. I present the theory than I will provide you with a calculator to do accurate amplifier selection.

Six videos covering these topics.

1. Introduction
2. "Power" Measurements
3. Low Impedance Loudspeakers
4. High Impedance Loudspeakers
5. An Important Distinction
6. Maximum Input Voltage (MIV)
7. Audio and Acoustic Levels
8. Crest Factor (CF)
9. Power from a Voltage Rating
10. Voltage from a Power Rating
11. Loudspeaker Impedance
12. Signal Spectrum
13. Signal Power
14. The Role of Impedance
15. Impedance-Independent Amplifier Sizing
16. Amplifier Sizing Calculations
17. Over/Under-Powering a Loudspeaker