Technical Articles

The Distributed-Mode Loudspeaker (DML) as a Broad-Band Acoustic Radiator (Pre-Print #4526)

Neil Harris and Malcolm Omar Hawksford

Abstract

The principles of a new class of acoustic radiator (DML) are described and the counter-intuitive result for broad-band frequency independent acoustic radiation established. It is demonstrated that a low-loss panel with optimal modal distribution produces a flat power response. A simple mechanical model is presented to calculate the mean velocity within the panel as a function of frequency and intrinsic properties.

Presented at the 103rd Convention, Audio Engineering Society, 1997 September 26-29, New York

The study report can be downloaded from the internet ($10) at the AES website. Search by Pre-Print number or author name. http://www.aes.org/publications/preprints/search.htm

Boundary Interaction of Diffuse Field Distributed-Mode Radiators (Pre-Print #4635)

Henry Azima and Neil Harris

Construction

Performance

Abstract

Traditional phase-coherent acoustic radiators are subjected to destructive interference when they interact with their boundaries. A new class of acoustic radiator is discussed whose radiation is spatially and temporally diffuse, mitigating the problem by producing sympathetic boundary reflections. Results from computer simulations for both classes of radiator are presented, and these are compared to single boundary and listening room measurements.

Presented at the 103rd Convention, Audio Engineering Society, 1997 September 26-29, New York

The study report can be downloaded from the internet ($10) at the AES website. Search by Pre-Print number or author name. http://www.aes.org/publications/preprints/search.htm

Distributed-Mode Loudspeaker Radiation Simulation (Pre-Print #4783)

Joerg Panzer and Neil Harris

Abstract

A radiation model of the Distributed Mode Loudspeaker (DML) is investigated and compared to measurements. The approach makes use of the bending wave eigen-functions and Fourier transformation to describe the acoustic coupling. The model is implemented into a lumped element simulator, which helps to display the complete system response including exciter and other components.

Presented at the 105th Convention, Audio Engineering Society, 1998 September 26-29, San Francisco

The study report can be downloaded from the internet ($10) at the AES website. Search by Pre-Print number or author name. http://www.aes.org/publications/preprints/search.html

Evaluation of Distributed-Mode Loudspeakers in Sound Reinforcement and PA Systems (Pre-Print #4758)

Peter Mapp and Vladimir Gontcharov

Abstract

The unique signal generation and radiation characteristics of Distributed Mode Loudspeakers (DML) suggests that they should find effective application in Sound Reinforcement and Public Address / Announcement systems. In particular, their reduced boundary interaction and diffuse, wide radiation properties should be of benefit. This paper reports the results of theoretical modeling studies, and both site and laboratory measurements. It is shown that the Distributed Mode Loudspeakers can be successfully employed in such situations but that traditional sound system assessment techniques may need revising and extending in order to adequately deal with this class of loudspeaker.

Presented the 104th Convention, Audio Engineering Society, 1998 May 16-19, Amsterdam, The Netherlands

The study report can be downloaded from the internet ($10) at the AES website. Search by Pre-Print number at http://www.aes.org/publications/preprints/search.html

The Intrinsic Scalability of the Distributed Mode Loudspeaker (Pre-Print #4742)

Graham Bank

Abstract

A Distributed Mode Loudspeaker (DML) operates by introducing bending waves into a panel, which has specified mechanical properties. Although the dimensions of the panel will affect the bandwidth, the sound radiated from such a panel will be diffuse in nature, and the directional characteristics should be substantially independent of its size. Both the theoretical justifications as well as some practical comparisons are given.

Presented at the 104th Convention, Audio Engineering Society, 1998 May 16-19, Amsterdam, The Netherlands

The study report can be downloaded from the internet ($10) at the AES website. Search by Pre-Print number or author name. http://www.aes.org/publications/preprints/search.html

Measurement Aspects of Distributed Mode Loudspeakers (Pre-Print #4970)

Vladimir P Gontcharov, Nicholas P R Hill, Valerie J Taylor (New Transducers Ltd, Huntingdon, UK)

Abstract

The complex radiation pattern generated by distributed mode loudspeakers makes a single-point measurement an inadequate representation of the sound field. In this paper we discuss simple multiple-point measurements as appropriate characterisation tools. These techniques are used to determine the total power, together with its directivity, and are equally applicable to both distributed mode and conventional cone loudspeakers.

Presented at the 106th Convention, Audio Engineering Society, 1999 May 8-11,

Munich

The study report can be downloaded from the internet ($10) at the AES website. Search by Pre-Print number or author name. http://www.aes.org/publications/preprints/search.html

The Complex Loudspeaker - Room Interface, Some Further Insight (Pre-Print #5059)

Peter Mapp Associates, Colchester, Essex, C03 4JZ, UK, Henry Azima & Vladimir P Gontcharov (New Transducers Ltd, Huntingdon, UK)

Abstract

The Loudspeaker - Room soundfield is examined by means of both traditional steady state measures and impulse based measurements including Direct to Reflected Sound ratios, Lateral Energy Fraction and Modulation Transfer Function Measurements together with Cross Correlation analyses and reflection direction and intensity studies. It is shown that Distributed Mode Loudspeakers generate significantly different sound fields as compared to conventional cone based devices both in terms of their spatial and correlation characteristics. The results provide new insights into the Loudspeaker - Listening Room Interface and are shown to have implications from both a psychoacoustic point of view as well as for sound system design in general.

Presented at the 107th Convention, Audio Engineering Society, 1999 September 24-27, New York

The study report can be downloaded from the internet ($10) at the AES website. Search by Pre-Print number or author name. http://www.aes.org/publications/preprints/search.html

Diffusivity Properties of Distributed Mode Loudspeakers (Pre-Print #5095)

Vladimir Gontcharov and Nick Hill (New Transducers Ltd, Huntingdon, UK)

Technology

Abstract

A method involving the evaluation of the Cross-Correlation Function has been developed to describe the diffusivity of direct sound radiation. The dependence of

the spatial correlation of the radiation field on sound source properties and frequency has been investigated. This work has highlighted the diffuse nature of the sound field of a Distributed Mode Loudspeaker and the correlated output of a conventional cone loudspeaker.

Presented at the 108th Convention, Audio Engineering Society, 2000 February 19-22, Paris

The study report can be downloaded from the internet ($10) at the AES website. Search by Pre-Print number or author name. http://www.aes.org/publications/preprints/search.html

Distributed Mode Loudspeaker Resonance Structures (Pre-Print #5217)

Dr. James Angus (University of York)

Abstract

The distributed mode loudspeaker's performance is analyzed with reference to its resonance structure. In particular the effect of the wave propagation type, shear or bending, over the frequency range is examined. The paper also examines the effect of diffusing boundaries on the resonance structure.

Presented at the 109th Convention, Audio Engineering Society, 2000 September 22-25, Los Angeles

The study report can be downloaded from the internet ($10) at the AES website. Search by Pre-Print number or author name. http://www.aes.org/publications/preprints/search.html

Spatial Bandwidth of Diffuse Radiation in Distributed Mode Speakers (Pre-Print #5412)

Neil Harris (New Research Centre, Huntingdon, UK) and Malcolm O J Hawksford (University of Essex, Colchester UK)

Abstract

The degree to which radiation from a loudspeaker is diffuse may be quantified by a spatial correlation function normalised to the on-axis response. This is true for any loudspeaker type, including the distributed-mode loudspeaker. However, because of the variation in material damping and design-related constraints, correlation commonly varies both with frequency and direction. A modified function, the offset spatial bandwidth of correlation function, is introduced as a

means of describing diffuse performance and quantifying its variation over the radiation field.

Presented at the 111th Convention, Audio Engineering Society, 2001 September 21-24, New York

The study report can be downloaded from the internet ($10) at the AES website. Search by Pre-Print number or author name. http://www.aes.org/publications/preprints/search.html