Modeling The Directional Response Of Slim Height Channel Speakers

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Abstract

Modern home audio products are starting to feature dedicated upward firing height channel speakers, which are a combination of unique physical speaker design and special signal processing, to reproduce audio as if the sound source is located in the ceiling. Due to slim form factor design constraint, devices like television sets pose significant challenges on the directional response and the amount of acoustic energy radiated from dedicated height channel speakers towards the ceiling.

To overcome these difficulties, a novel acoustical hardware solution of integrated acoustical reflector design for slim height channel speakers that are completely occluded by the television set panel, with one inch overall integrated reflector - speaker thickness, yet capable of re-distributing acoustic energy from the speaker source to create a wide height channel sweet spot around the typical viewer position is explored in this paper using both acoustic FEM and BEM simulation techniques within COMSOL Multiphysics®.

Acoustic FEM study focuses on modeling and optimizing the target frequency response at the height channel speaker module level. The results of the FEM study are validated with experimental results obtained from the KLIPPEL Near Field Scanner System. Acoustic BEM study relates to modeling the acoustic energy propagation from the speaker source while mounted on a TV panel towards the typical viewer position considering ceiling reflections, to numerically demonstrate the benefits of acoustic reflector design on enhancing the directional response of slim height channel speakers.