FUJITSU TEN Limited has developed "TOYOTA Premium Sound System" using "spatial control technology" for CROWN of TOYOTA Motor Corporation in February 2008, which receives high reputation. We, at FUJITSU TEN Limited, and UNIVERSITY OF HYOGO have been collaborating on research activities of sound field creation technology by a simultaneous equation method through the upgrade of the spatial control technology in order to provide sounds with more natural sense of expanse. Through verifying the principle with a simulation model, we confirmed that it provides appropriate controls depending on listener’s moves and creates arbitrary sound field at the periphery of listener’s ears. This new technology can provide precise controls depending on listener’s moves, and this leads to expansion of the spatial control range whose upper limit used to be 1.5 kHz. We found a clue to providing sounds with more natural sense of expanse.

Abstract

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Study of In-vehicle Sound Field Creation by Simultaneous Equation Method
2.1 Sound Concept

2.2 Spatial Control Technology and Effect

Task 1: Unnecessary vibration around the periphery of an installed speaker
Solution 1: Technology for suppressing unnecessary vibration

Task 2: Strong and slightly-delayed reflection sound generated from glass, etc.
Solution 2: Technology for suppressing unnecessary reflection sounds

Task 3: Only the reflection sounds with the limited incoming directions are received because the ceiling, seat and other materials absorb sounds.
Solution 3: Technology for addition of spatial information
2.3 Residual Task

3.1 Outline of Sound Field Creation Technology
Study of In-vehicle Sound Field Creation by Simultaneous Equation Method

3.2 Principle
3.2.1 Configuration

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3.2.2 Adjustment Method of Control Filter

When System is Operating

Control filter update equation

Auxiliary filter definition equation

When transfer characteristic of acoustic space (}
Study of In-vehicle Sound Field Creation by Simultaneous Equation Method

4.1 Simulation

Is the sound field characteristic at the periphery of a listener equal to the target sound field?

Is the sound field characteristic equal to the target sound field even after the change in the transfer characteristic of acoustic space?

4.2 Simulation Outcome
Conclusion

Profiles of External Writers

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