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Matlab programs manual Higher-Order Ambisonics

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1 Introduction

The programs present in the two folders are related to Higher-Order Ambisonics, a sound field synthesis method which was studied during a 5 month internship. The report 'HigherOrderAmbisonicsReport.pdf' contains elated details about what was done during the internship.

The folder 'ReportSorted' contains the programs sorted by the chapters present in the report.

The folder 'LibraryAndFunctions' contains the programs done during the internship as well as the toolbox created, needed for the use of the program.

2 Beforehand

In order to use the Matlab programs present in the folders it will be needed to download the toolbox folder 'MatlabFunction' and set the path of this folder in Matlab ('Add Path on Matlab help').

3 Toolbox 'MatlabFunction' in 'LibraryAndFunctions' folder

This section will explain the mains different function present in the toolbox and how use them.

But not today.

4 Program list folder 'LibraryAndFunctions'

4.1 Folder 'Measure'

This folder contains the programs related to the measurement.
ExtractFRF.m allows to extract the FRF of all the loudspeakers in the ambisonics set-up measured with a spherical microphone array (aiming room compensation).

CalibrationPiston.m sends back a .mat file containing the rms value of the different microphones used. It takes in input the record of the microphones using a pistonphone.

MeasurementCalibration.m calibrates the measurement done with an array of microphone using the calibration file of the precedent program.

Folder 'Antenna'

Extraction_antenne.m allows to see the sound pressure field from a measurement of a plane microphone array at a desired frequency with an arrow of the direction of the intensity. Takes in input a measurement from a plane array and the signal used for the measurement. (typically a sweep).

Extraction_antenne_comparison.m compare two field measured with a plane microphone array. It plots the two field at a given frequency with an arrow indicating the direction of the intensity and the error field.

MicSph

MicSph_ExtractMeas.m extracts the measurement from a spherical microphone array and plot the sound pressure field at a given frequency with an arrow of the direction of the intensity.

Measurement_Comparison.m compare two field measured with a spherical microphone array. It plots the two field at a given frequency with an arrow indicating the direction of the intensity and the error field.

4.2   Folder 'Theory'

In this folder there are several programs referring to the ambisonics theory.

'HOA_Sam.m' presents the simulation of a monopole source and its ambisonics reproduction with different parameters (truncation order, frequency, position...)

'Simulation_Spherical_Microphone.m' presents the simulation a recorded monopole through a spherical microphone array.

NFC_Filters.m presents the simulation of the near field filters used to compensate the monopole behaviour of the reproduction speaker as well as the near field compensation of the monopole encoding.

OrthogonalityErrorLebedevQuadrature.m presents the orthogonality error matrix associated to a Lebedev meshing

'GuiMicSph' folder

In the folder 'GuiMicSph', there is a GUI which allows to load measurements of a monopole source (input and output) from a spherical microphone array record and compare it to the simulation. Run *'Guifig.m'*. If there is no measurement data it still possible to see the simulation part by entering location a source.

'Encoding' folder

This folder contains several programs related to the ambisonics encoding. *'EncodingFilters.m'* presents the filters using a open sphere and rigid sphere microphone array.

'regulatisationTikhonov.m' presents the regularised filters using Tikhonov regularisation, in order to limit the noise in real measurements.
'regulatisationRtarget.m' presents the regularised filters aiming a reconstructed area, in order to limit the noise in real measurements.

'Gui_HOA_monopole' folder

This folder contains a GUI version of the program *'HOA_Sam.m'*. Download folder and Run *'recons.m'*