

Surround Sound Using Variable-Ambisonics and Variable-Polar Pattern Theories

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Abstract—This paper details the technologies displayed by the authors at ICME 2012. The technologies are those of Variable-Ambisonics and Variable-Polar Pattern Reproduction. These technologies are demonstrated using virtual 2-dimensional speaker layouts via binaural headphone reproduction. The technologies offer benefits over standard pair-wise panning of surround sound by offering on-the-fly changing of speaker count, source width control and per sound source rendering. The technologies also overcome problems of Ambisonics and Ambisonic based reproduction methods by allowing each sound source to be individually rendered by decoder type, of an arbitrary rather than fixed order and the mixing of various orders within the same reproduction system.

Keywords-Ambisonics; variable-order; variable-decoder; 2D; 3D; two-dimensional; polar pattern; surround sound;

I. INTRODUCTION

Many spatial audio techniques have been presented; Ambisonics, Vector Base Amplitude Panning, DirAC and Wave Field Synthesis to name a few. These technologies for the most part have failed to become popular and in widespread use. However technologies such as 5.1 and 7.1 which can be evaluated to be inferior have succeeded, at least partly into the mainstream, with their inclusion on DVD and/or BluRay. One reason for the lack of adoption to spatial audio is the high channel count needed for reproduction, both in terms of playback from a Digital Audio Workstation (DAW) and equipment needed. Further to this, integration of spatial audio rendering into current workflows has been problematic.

II. TECHNOLOGIES

The theory of variable-order, variable-decoder Ambisonics has been accepted for publication [1]. The technology is designated for 2D reproduction, originally over an octagonal speaker layout. The technology broke the limitation of using a fixed order and fixed decoder type for Ambisonics production and playback. By eliminating the B-Format transport method and encoding directly to the speakers, as say 5.1, each sound source can be panned using variable-order and variable-decoder. This system also leads to the use of sound sources that are of different orders within a single environment. The system developed uses a host DAW connected to a spatialisation application. A multimedia piece was produced using this system entitled ‘Mechanics of Love’.

The author built on this idea to produce a system that used a variable-polar pattern that is reproduced over a 2D reproduction array. This is similar to the outcome of an Ambisonics reproduction. The use of a variable-polar pattern and variable-order is more intuitive than the prior method. A system developed using this technology uses a DAW and VST plug-in sending OSC (Open Sound Control) messages to a spatialisation application.

III. DEMONSTRATION

All audio in the demonstration is reproduced over headphones using binaural HRTF convolution. The demonstration will consist of three mini-demos:

- A video showing an excerpt of ‘Mechanics of Love’. The video switches between the finished media and the DAW environment showcasing the spatialized audio, control method and automation of parameters.
- Video footage of a multi-instrument audio mixture whereby the automation of parameters is demonstrated whilst text overlay describes how a sound source is being altered. The video will switch sources between different techniques to show they can be simultaneously reproduced.
- A realtime application where the user can move a single auditory sound source around a virtual 2-dimensional array of speakers. The user can change between the two techniques with full control of the parameters. Thus allowing the user to audition the techniques sequentially, hearing the creative use of a spatial audio renderer.

The demonstrations give conference members the chance to experience the produced material from using a spatial audio system, test a system with their own choice of parameters and see how the workflow is used within a standard DAW environment.

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REFERENCES

- [1] M. J. Morrell and J. D. Reiss, “A 2d variable-order, variable-decoder, ambisonics based music composition and production tool for an octagonal speaker layout,” in *CMMR 2012: Music and Emotions*, 2012.