Research Goals in Digital Music: A Ten Year View

⠏ Sound Reproduction and Recording

Among the most critical processes in the chain of digital music production and its reception are those of sound recording and reproduction. These are well advanced but there are still many potential developments in transducer technology, and in the capture and reproduction of sound fields. While these areas of research may seem to lie outside the digital musical domain, many sophisticated approaches to sound reproduction require digital control, processing or encoding systems.

Loudspeaker developments have occurred in many areas such as efficient loudspeaker/amplifier configurations, **directivity-controlled arrays, digital loudspeakers**, and the application of **ultrasonic parametric arrays**(e.g. HSS). Other developments in this area and new digitally controlled sound reproduction systems are likely to evolve over the next ten years. There is a requirement, by both professional and domestic users, for **loudspeaker systems** which are portable, light, capable of sustaining high sound pressure levels, multiple audio channels and high quality audio output.

Domestic sound reproduction systems have evolved in recent years. Surround sound systems are widespread, and DVD systems have led to surround being considered as a new hifi and audio standard. Existing methods of **surround encoding** vary. There are a number of approaches ranging from matrixed surround sound capture methods, to systems which provide a surround sound effect, often driven by a requirement for efficiency in the use of multiple loudspeakers and channels.

Future surround systems may use many more channels of audio and more loudspeakers or more efficient sound encoding strategies.

Several contemporary technologies exist which may be capable of improving **surround sound reproduction** so that it is capable of delivering more convincing three-dimensional immersive experiences. Wavefield synthesis, binaural head-related-transfer-function approaches, and Ambisonics are technologies which can be developed over the next ten years, but research into audio encoding strategies will rely upon complementary research in **human perception of sound, psychoacoustics, loudspeakers** and **listening tests**.

It will also be necessary to progress research into methods to **capture surround sound fields** efficiently in a variety of locations.

Audio recording systems are well developed. High sample rates, larger audio sample word lengths and good digital audio storage facilities are provided by contemporary systems. While it

would seem that older research questions about computation and data storage are solved, multiple audio channels for surround sound and complex new control systems will continue to stretch **computational performance** and storage/delivery bandwidth (see Music Exploitation and   Distribution).

The application of **high level parameters** in professional software **recording environments** and the integration of audio content tracking, through the application of MIR research outcomes and search technologies (as exemplified in the Semantic HiFi project), will be possible from the current research base.