Flat Planar Loudspeaker Design

Student: Frederick Kwek J. K. 2266326
Supervisor: Adjunct Professor W. H. Holmes

1. Introduction & Aim

1.1 Introduction
There are three methods of creating sound, these are the dynamic drivers, the planar magnetic/ribbon transducer, and the electrostatic panel. A loudspeaker using dynamic drivers is often called a box loudspeaker because the drivers are mounted in a box-like enclosure. Ribbon and electrostatic loudspeakers are called planar loudspeakers because they are often mounted in flat, open panels.

1.2 Aim
The aim of this thesis is to design & build a planar loudspeaker to provide the highest standard of innovative design, and deliver breathtaking high-end sonic performance.

2. Planar Versus Dynamic Drivers
Conventional speakers have a distinctive problem because the sound produced is box-constricted. The dynamic driver fails in that it projects the music like it is coming out of boxes on the floor. However, as for a planar driver, its principle eliminates these problems by projecting sound from top to bottom, giving the sound height as well as stereo width and depth.

3. Planar Magnetic Loudspeakers
These designs make use of printed voice coil circuits on sheet of tensioned light plastic, with appropriate layout of ferrite bar magnets arranged in a frame adjacent to the plastic sheet and on both side of it. Openings in the magnet frame provide sufficient egress of sound.

3.1 Diaphragm
Using a 12.7 micrometer thick Mylar diaphragm and a 25.4 micrometer conductive aluminum ribbon this di-pole, cabinet-less design leaves the sound absolutely uncoloured by box resonances. The impedance is flat through out the audio frequency bandwidth.

4. Design Prototypes

4.1 High Current Loop Planar Loudspeaker
According to the Fleming’s left hand rule, we can exploit this magnetic flux to induce motion to a diaphragm by placing current-carrying conductors bonded on a sheet of Mylar in the magnetic flux. In this manner, sound can be created with an audio signal injected to the conductive membrane.

4.2 Electromagnetic Planar Loudspeaker
This system uses electromagnetic coils to create magnetic flux to excite the Mylar diaphragm. In a sense, it is the magnetic equivalent of a push-pull electrostatic speaker, differing in that it requires no step-up transformer or bias voltage, and that the audio signal is applied directly to its diaphragm.

5. Measurement Results

5.1 Frequency Response of HCL Planar

5.2 Frequency Response of EPD Loudspeaker

6. Conclusion
Both design methods have proved to be promising for further research. In conclusion, after the completion of both loudspeaker prototypes, I feel that loudspeaker design is still largely an art. Engineering will guide the way, but it is no substitute for good taste, good sense and musical sensitivity. If engineering were all it took, there would be no bad or even mediocre loudspeakers to think about.