



Flat Panel Guitar Amplifier

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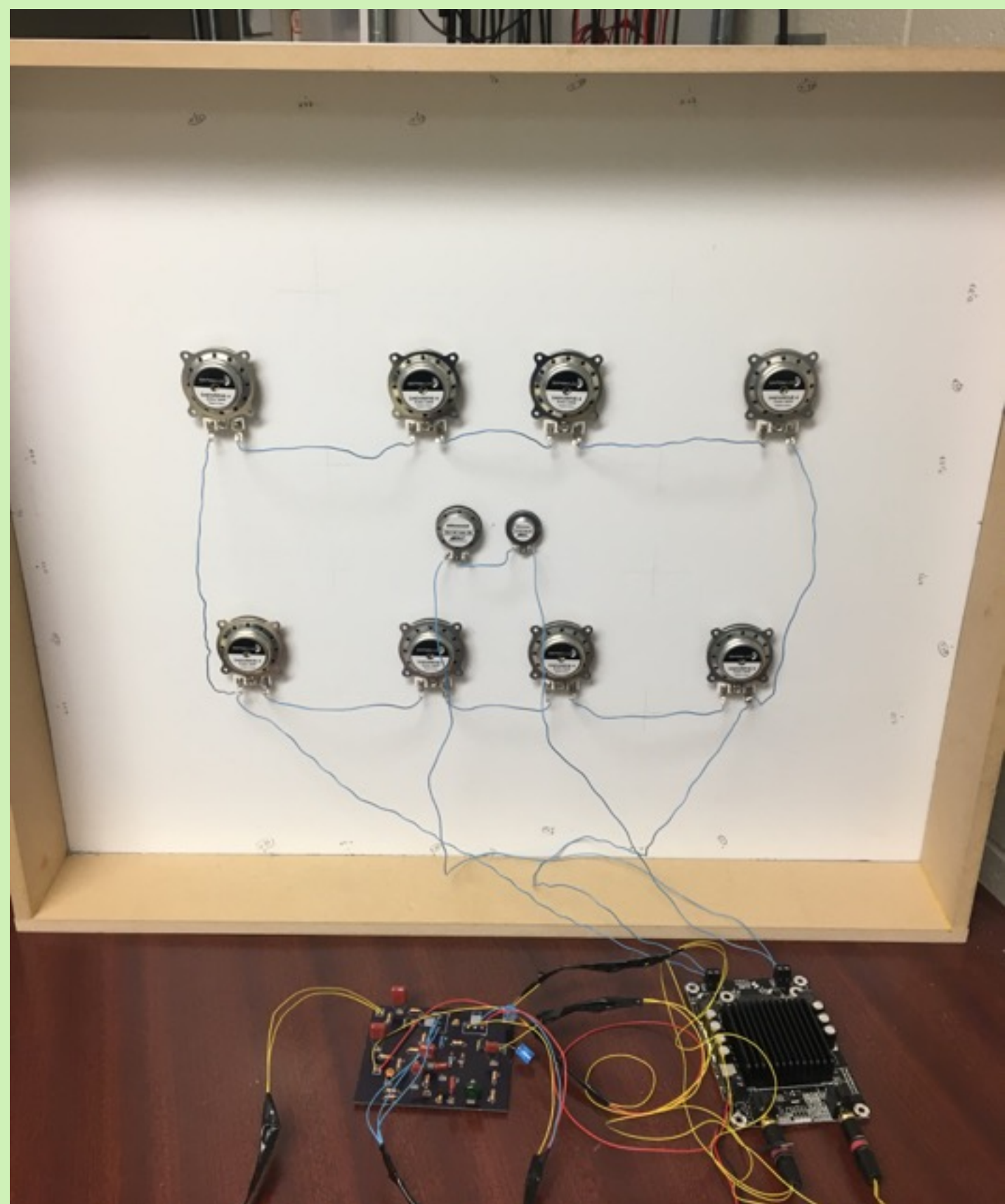
INTRODUCTION

- An amplifier takes the electrical signal from an acoustic, bass or electric guitar and strengthens it so that it can be played through a loudspeaker.
- A flat-panel speaker, otherwise known as a distributed mode loudspeaker (DML), is a speaker where specifically placed drivers distribute vibrations across the panel in modes in order to produce sound.
- The combination of these two concepts is how this flat-panel guitar amplifier was made.

PROTOTYPE

Gator Board

- Dense inner core made of foam and a rigid exterior made of wood-fiber veneer
- 24 by 28 inches
- 3/16 inches thick
- Young's modulus = 1.5×10^9
- Poisson's ratio = 0.35
- Density = 222 kg/m^3



FUTURE WORK

- Amplifiers for specific instruments such as keyboards and bass guitars.
- More compact, portable versions.
- Flat panel speaker implementation in TVs, cellphones and cars.

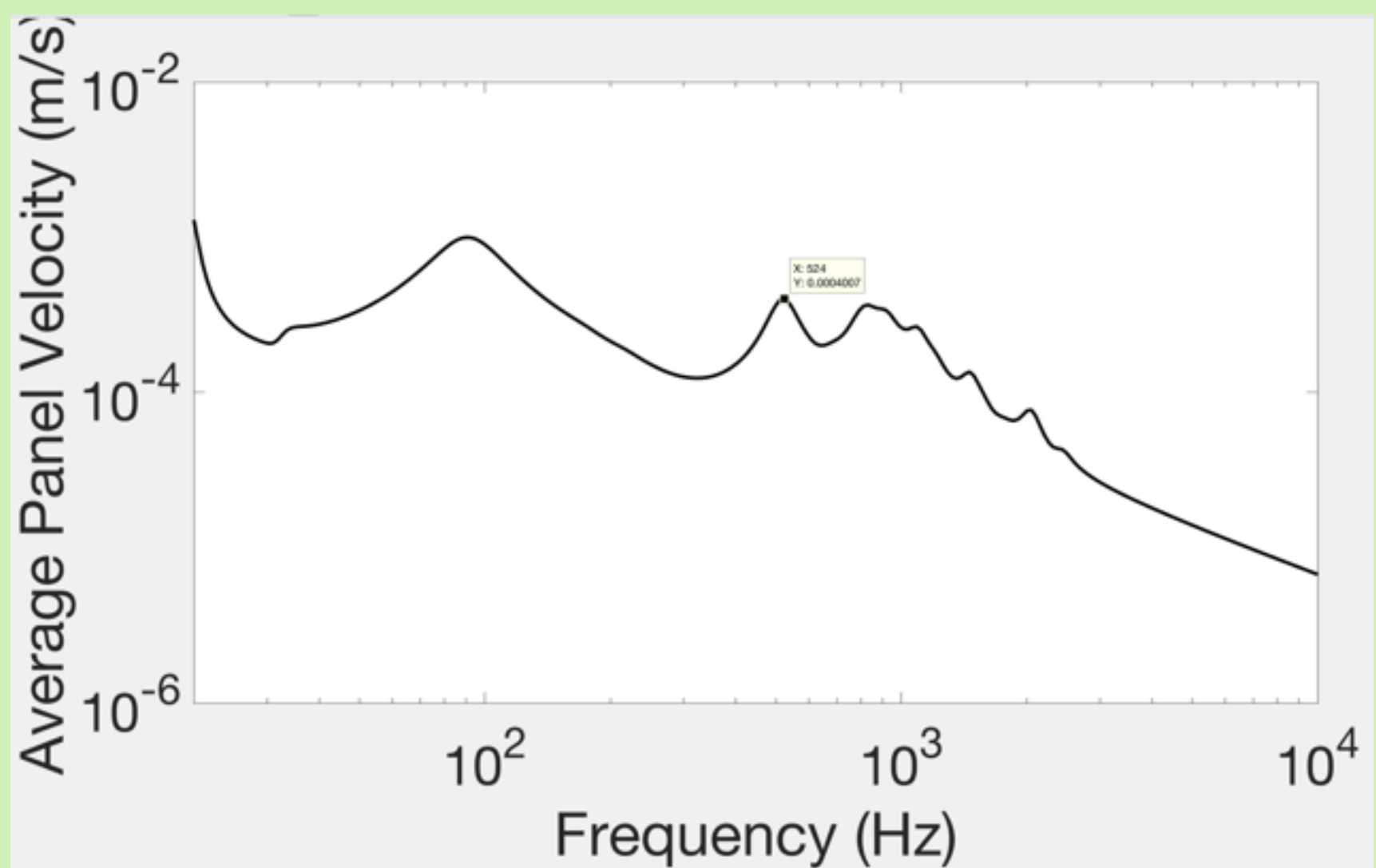
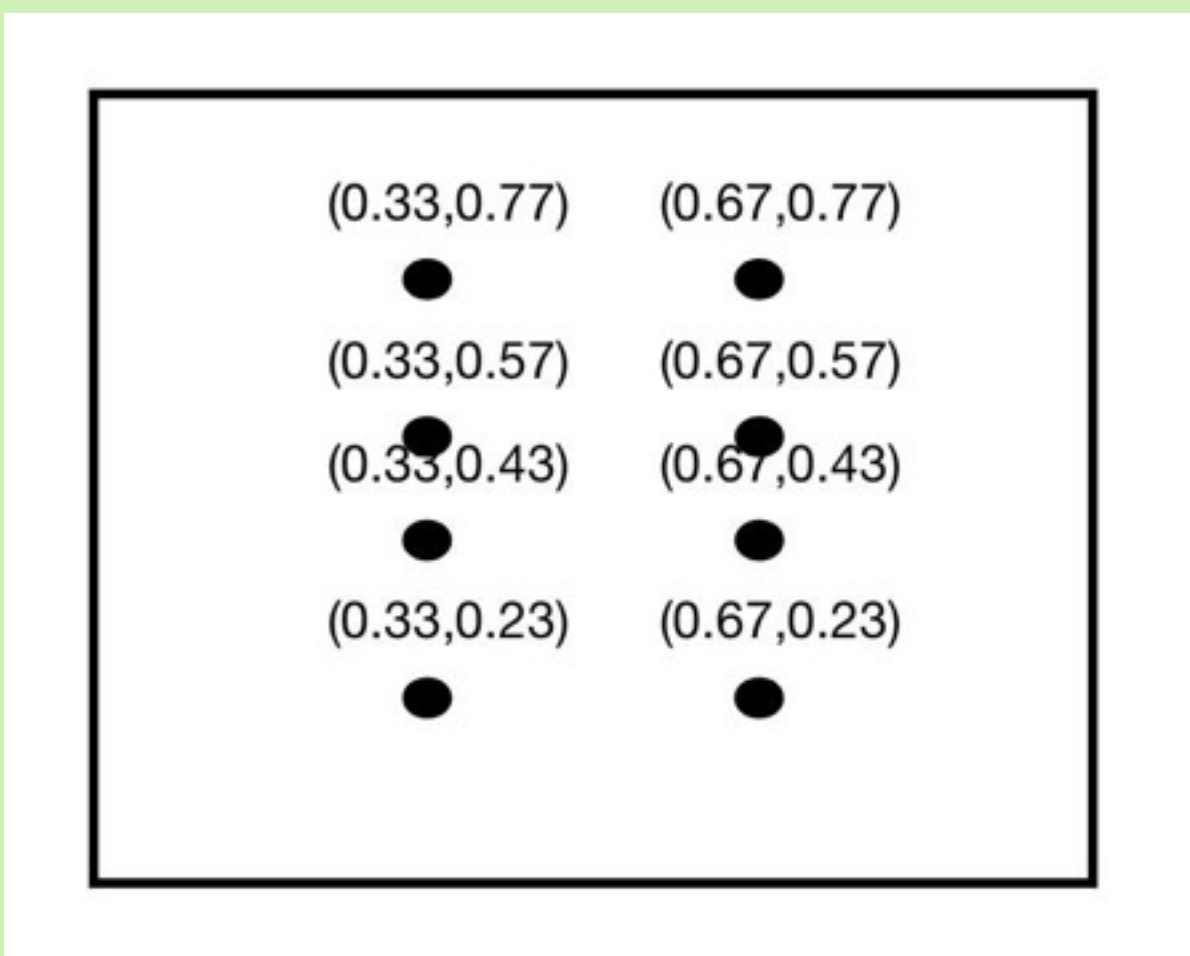
ACKNOWLEDGMENTS

I would like to thank Dave Anderson for advising this project and Paul Osborne for assistance in constructing the amplifier.

SIMULATIONS

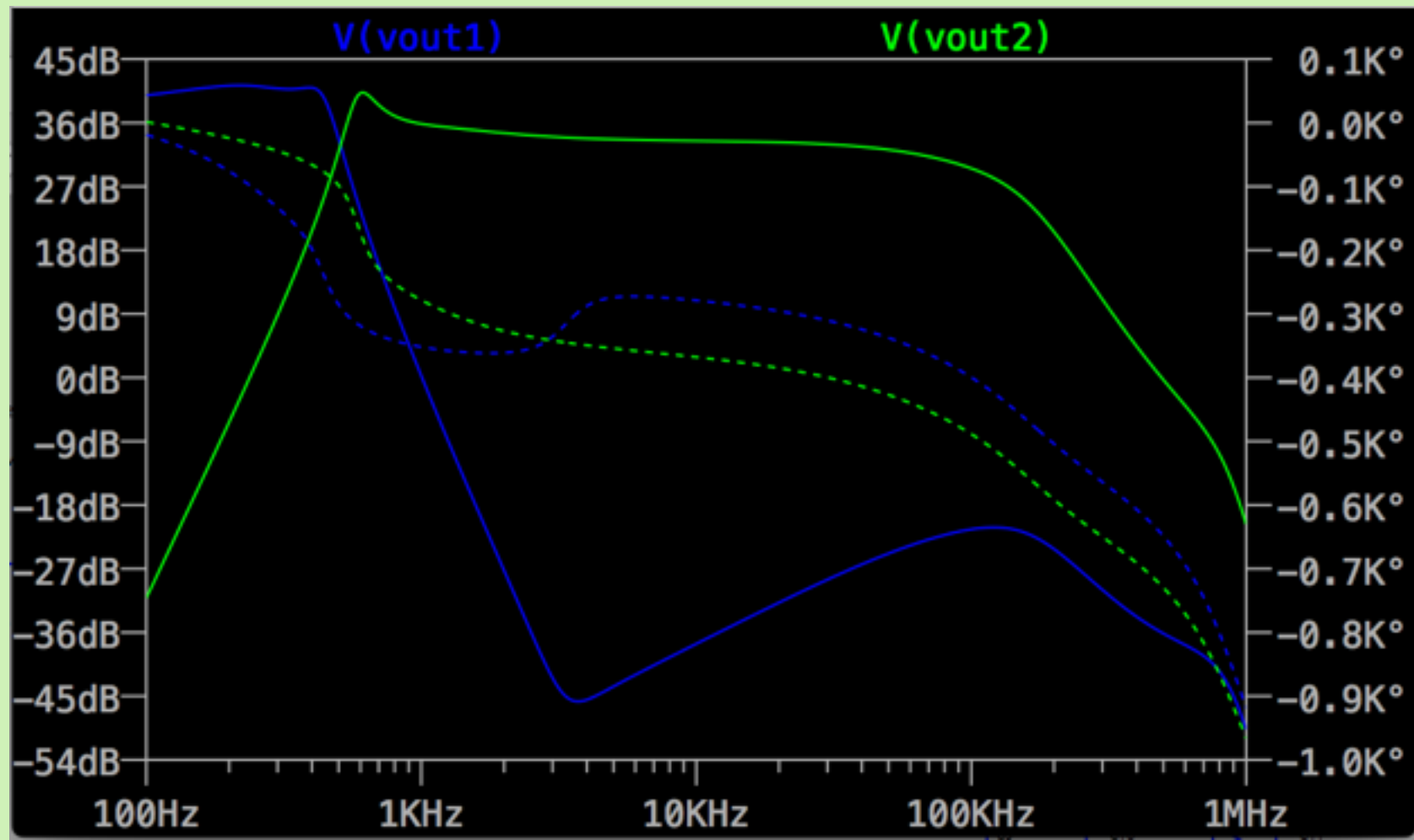
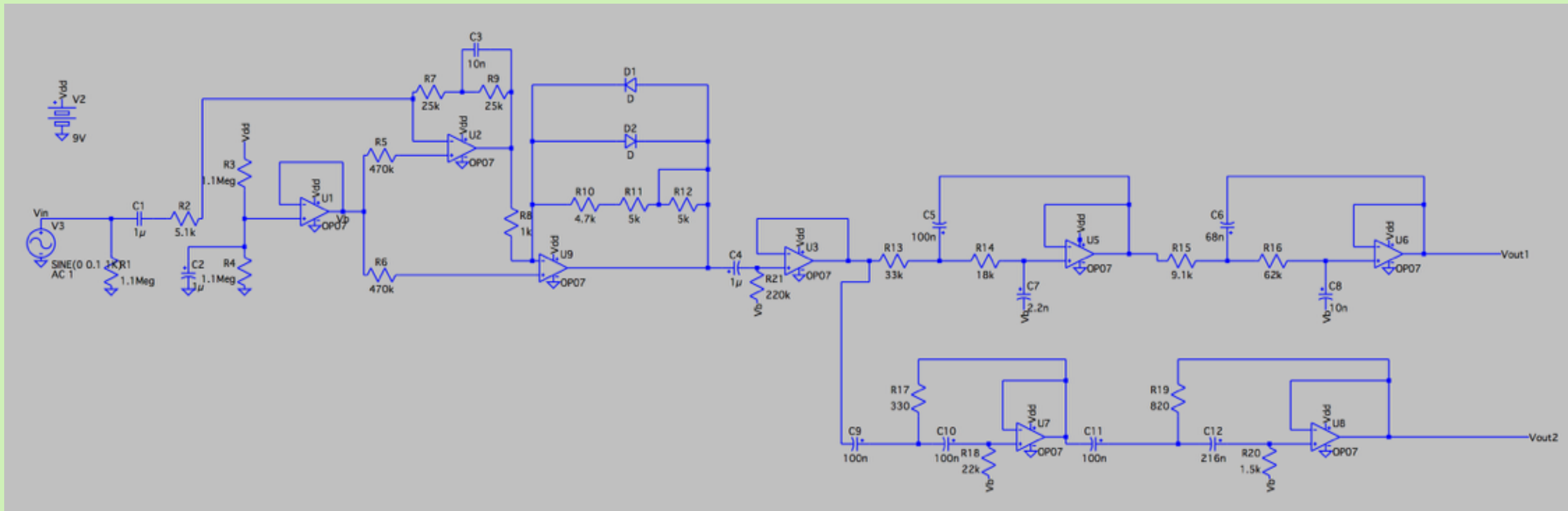
MATLAB

MATLAB was used to calculate the placement of the drivers and where the crossover frequency should be.



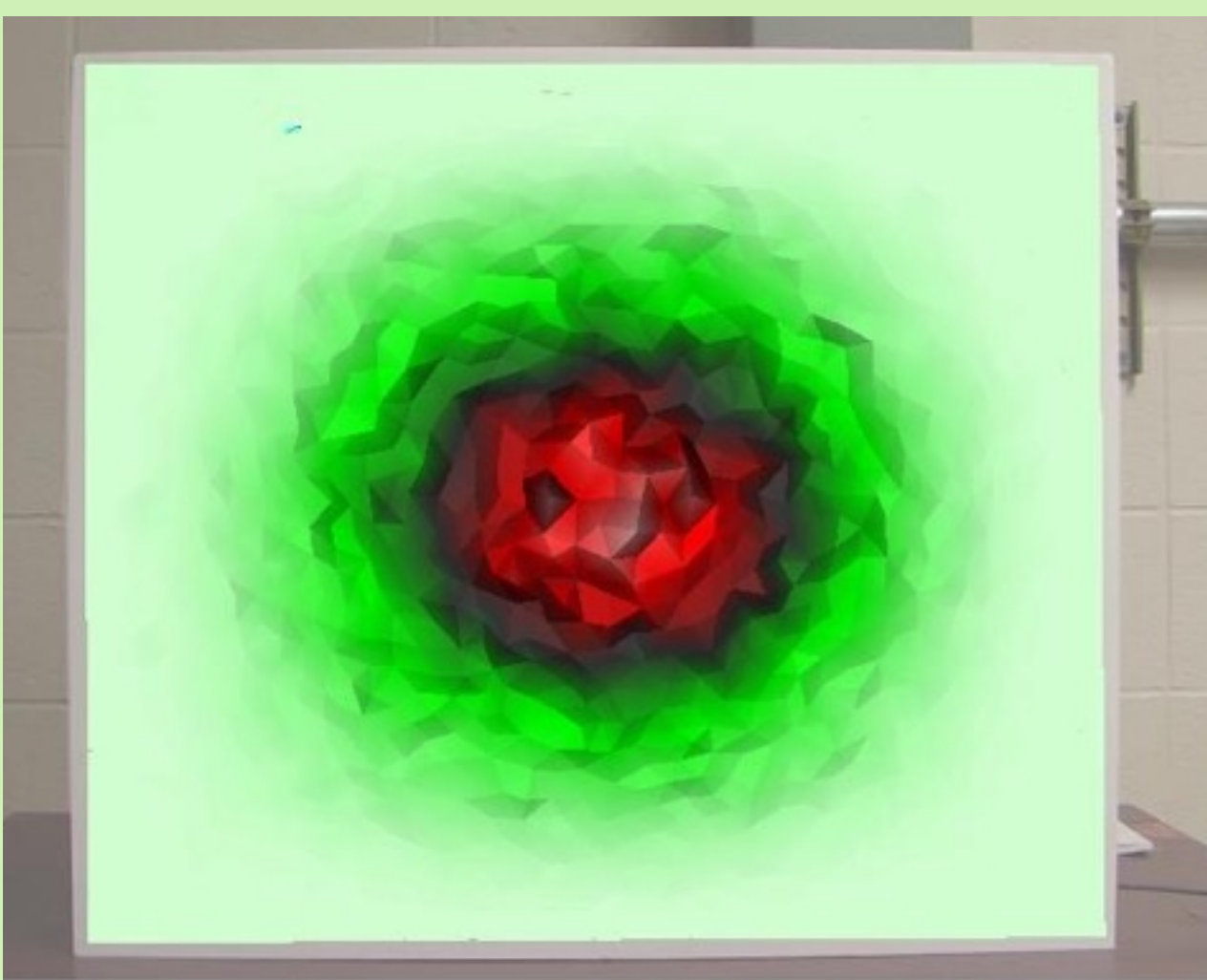
LTSpice

A simulation was carried out in LTSpice to verify the frequency of the crossover network.

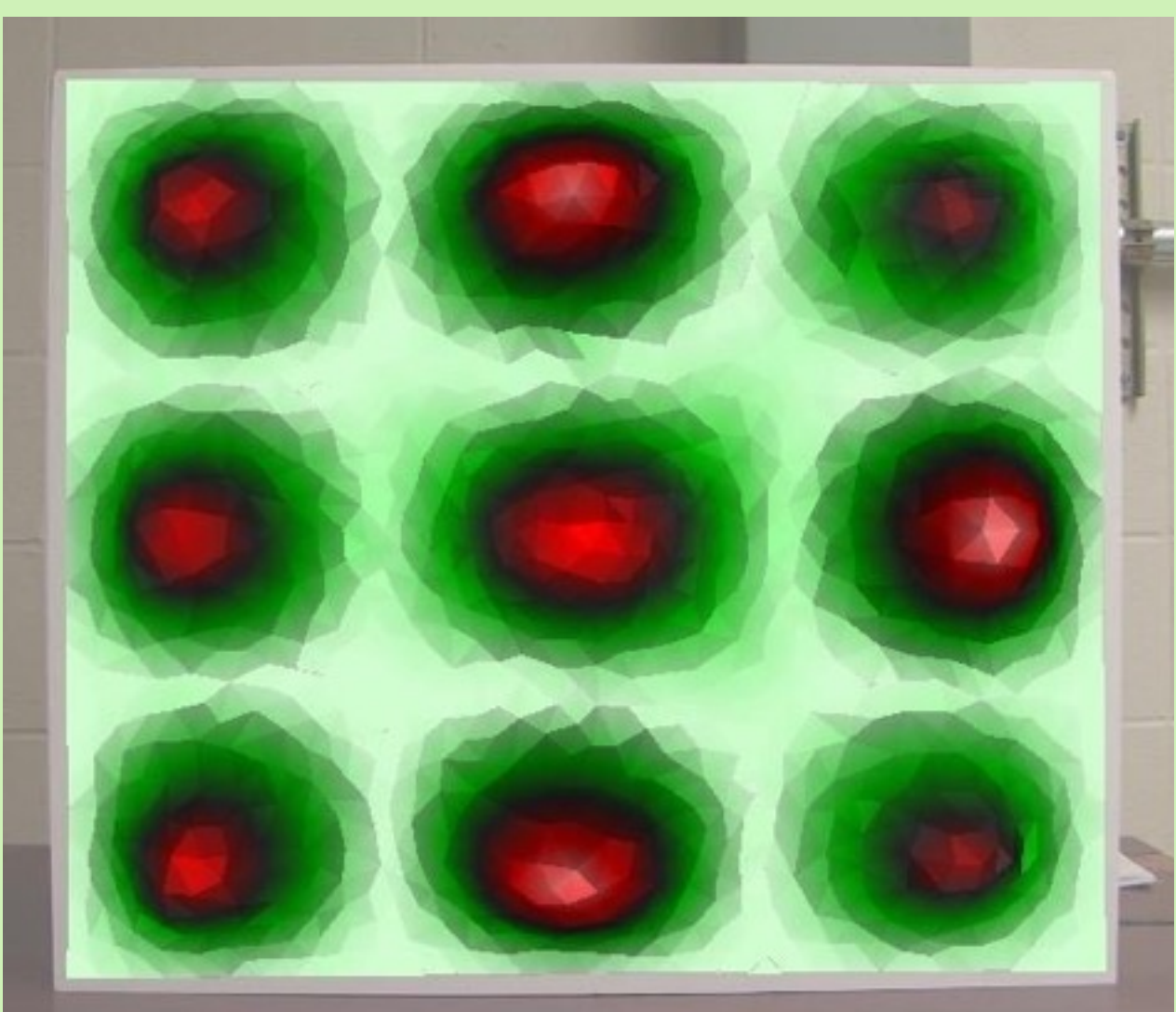


MECHANICAL MEASUREMENTS

- Scans were made with a laser vibrometer.
- Displays average surface velocity as a function of frequency.
- Shows how the panel is moving.



- Driver placement designed to excite the lowest (1,1) mode.
- (1,1) mode occurring around 63 Hz
- Panel resonance should be greater than driver resonance (30 Hz) for optimal movement of the panel and best sound reproduction.



- (3,3) mode occurring around 381 Hz