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Mechanical Engineering

Conformal Parametric Array

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The acoustic parametric array exploits the nonlinearity of air to create an audible sound beam that can propagate long distances. Transmitted signals are modulated around a nominal 40 kHz carrier, creating sum and difference components as the signal propagates through air. Since attenuation is proportional to frequency squared only the low-frequency difference component remains at long distances. Current commercially-available parametric arrays arrange ultrasonic transducers in a planar array to create a beam of sound that is audible at distances up to 100 m. Our goal is to create a concave parametric array to determine if the added geometrical focusing allows for tighter spatial control of the audible signal. Ultrasonic transducers were mounted on a flexible 3D printed structure to create an array with variable curvature.

The main goal of this project was to test if creating a concave parametric array would allow for further focusing of the sound output from the transducers. The first steps in solving this question was gathering data on the commercial linear parametric arrays that are being used now. Upon gathering the data and plotting the results, it was then time to create a concave surface that would allow for the focusing. A NASA concept part was taken from a 3D printing site and redesigned to allow for mounting of the transducers and wiring of the transducers as well. Then a structure was created that the concave surface could be mounted to and allow for the user to change the angle of the concave surface.

The research that was done was on the two SoundLazer commercial linear parametric array. The conformal parametric array was unfortunately unable to be tested. This was due to the fact that the ultrasonic transducer that were ordered required a 20v power source, and at the moment the amplifier being used only outputs 10v. So, an op amp is currently trying to be created to take the 10v input and up it to the required 20v needed. From the data that was collected on the two commercial arrays however, shows that out past 50 yards there is a drop off in the audible sound but it carries out 100 yards. Once the conformal parametric array is running it is hoped that this sound dissipation is avoided and able to be focused so there is no sound radiation to the sides of the array.