CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
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Project Number
22675

Project Title
Active Noise Control: Reducing Noise by Adding Noise

Abstract

Objectives/Goals
The objective is to determine the effectiveness of active noise control as functions of noise frequency, noise type, and the distance between the noise and anti-noise sources. I also proved the principle of active noise control using an active noise control electric circuit board and headphones. My hypothesis is that active noise control is most effective with low frequency, and that the noise type and distance will not affect the performance of active noise control.

Methods/Materials
Materials used include a test chamber made of wood and acoustic foam, 2 speakers, a noise level meter, a sound synthesizer, and electronic components for my circuit board. Tests were conducted using noise and anti-noise sources of different frequencies (200 Hz to 1000 Hz) and different types (sine, sawtooth, squarewave, daily noises). To test the effect of distance, the speakers were separated from 2 inches to 8 inches. The sound level with and without active noise control is recorded as a function of frequency, noise source, and distance between the noise and anti-noise source. The electronic circuit board was tested with headphones to reduce background noises while listening to music.

Results
At two inches separation, the 200 Hz has an average of 30% reduction in noise intensity. Also, the sine and sawtooth function displayed similar patterns in cancellation. As the frequency increases, the percent of reduction decreases. At eight inches separation, the effect of frequency and wave shape is less significant and the average percentage of reduction is reduced as well. The test with the analog circuit shows about a 5-dB decrease in the background noise. 71% of those surveyed know about noise pollution. However, only 37% correctly answered how active noise control works.

Conclusions/Discussion
Active noise control is more effective with low frequency noises than high frequency noises. The shape of the noise source affects the results of active noise control. The sine and sawtooth function behaved similarly because of their similar shape. Also, active noise control performs better at shorter distances rather than father distances. Finally, people are aware of active noise control and noise pollution, but they are not aware about the details behind these topics. In conclusion, active noise control is affected by the frequency and shape of the noise and by the distance between the noise source and anti-noise source.

Summary Statement
Active noise control works well with low frequency noises and small distances between the noise and anti-noise, therefore headphones are the best application of active noise control.

Help Received
My mother helped format various materials. My father helped build apparatus and edit the report.