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SigSys Final Project Proposal
Acoustic Beamforming

For the SigSys final project, we plan to use an array of speakers with some phase offset to produce an acoustic beam, use a backdriven speaker as a receiver, and create a control loop to adaptively set the phases to produce destructive or constructive interference at a receiver. This will include constructing one or two oscillators to drive a set of speakers, a phase-shift filter (such as an integrator or differentiator) that is adjustable by voltage, a receiver rectification module to convert the received signal into an error signal, and an adaptive control module to take the error signal and produce a voltage that sets the phase offset. The ideal final deliverable would be (1) demonstration of the received signal changing as the receiver is moved through space without control, and then the received signal constant with control as it moves through space, along with another static receiver that changes as the controlling receiver is moved. Additionally, (2) a short written report documenting our circuit or an Instructables post detailing how to recreate our work depending on how successful we are. Either would include an explanation of signals and simple control theory underpinning its operation.

Incremental Development Sequence:
(Complete)
Build an Oscillator
Connect a Speaker
Backdrive a Speaker
        Observe output voltage, current

(To Do)
Build a phase-shift filter
        design: tunable by potentiometer
        observe effect of tunable phase shift on backdriven speaker (and so location)

        design: tunable by voltage/current input
        create module for transfer function from output voltage into phase shift, try to observe some feedback

Design corrective control circuit
Final: Get beam to follow receiving speaker