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6.101 Final Project Checkoff List - Lock-in Amplifier

Commitment

Ability to receive audio with audio amp + filter (evschell)
The signal measured after input amplifier and filter responds appropriately to changes in sound around the microphone. Ex: The amplitude increases when sound is increased.

Ability to Generate Light (evschell)
The LED outputs light and the current through the LED can be measured and matches the frequency and relative amplitude changes of the input voltage signal.

Ability to Detect Light (evschell)
The output of the transimpedance amplifier responds appropriately to changes in light in the viewing angle of the photodiode. Ex: The amplitude increases when light increases or signal matches the frequency of the input light.

Ability to Generate Sound (evschell)
The speaker plays audible sound.

Working reference oscillator (sadun)
The oscillator outputs a 100 kHz wave.

Working AM Mixers (sadun)
Putting a 440 Hz sinusoidal waveform and a 100 kHz wave into the modulator produces a 440 Hz modulation of a 100 kHz wave. Putting a 440 Hz modulation of a 100 kHz wave into the demodulator with a 100 kHz wave produces a 440 Hz tone.

Working Filters (sadun)
The various low-pass and band-pass filters surrounding the mixers reject the frequencies they’re supposed to.

Goal

Effective transmission of audio data (evschell)
All of the transducing, light, and sound modules work together, such that audio can be played into the microphone and heard on the other side from the speaker.

Effective AM Modulation and Demodulation (sadun)
When the output of the functioning AM modulator is hooked up to the input of the functioning AM demodulator, a 440 Hz sinusoidal waveform can be successfully transmitted.

Effective AM transmission of Audio
Input audio signal is successfully modulated with a reference frequency, sent across the light channel, demodulated, and played on the speaker.

Demonstration of improved noise performance
When the AM modules are used in the system, the output sound on the speaker and the signal on the receiving end is clearer than if the AM modules are not used.
**Stretch**

*Working VCO*

The output signal is periodic and its frequency changes with changing input voltage.

*Working Phase Detector*

Changing the phase of the input signal changes the DC output of the phase detector.

*Working Phase-Locked Loop*

The phase detector successfully stabilizes its output around 0 DC output. Putting an FM signal into the phase-locked loop produces demodulated output.

*Demonstration of improved noise performance*

When the FM modules are used in the system, the output sound on the speaker and the signal on the receiving end have less noise than when the AM modules or no modulation is used.