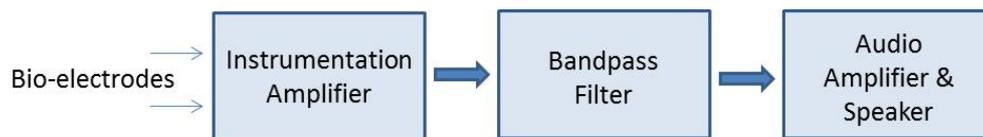


## Design of an EMG Amplifier – part 4

### Introduction:

You are tasked to design and validate an EMG amplifier that will produce sounds proportional to the intensity of the EMG signal measured with bio-electrodes. The amplifier works with a single 5V dc voltage supply source. The basic layout of the amplifier is shown below. The instrumentation amplifier amplifies the difference between the potentials captured with the 2 bio-electrodes placed on the muscle. The bandpass filter attenuates the frequency signals outside the range of the normal EMG. The audio amplifier produces a replica of the bandpass filter output signal with more power (current) to energize the loudspeaker.



In part 4 of this laboratory, you will finish your measurements and characterization of the system and demonstrate its operation with actual EMG measurements on arm muscles.

### Prelab:

There is no new prelab material to prepare, but you should review the circuits and data sheets for the components used in your circuit. This will help you interpret your measurements and debug your circuit.

### Report:

Each work group will submit a report due one week after the laboratory experiment which should include the following sections:

1. Complete circuit drawn in Multisim
2. Characterization of each functional block of your system
  - a. Measurement of frequency response curve of the two filters, expressed as  $V_{out}/V_{out_{passband}}$  (frequency). The Y axis should be expressed in dB
  - b. Identification of experimental critical frequency for each filter
  - c. Measurement of common-mode gain and differential gain for the instrumentation amplifier
  - d. Frequency response curve of the instrumentation amplifier, also expressed as  $V_{out}/V_{out_{passband}}$  (frequency) with the Y axis expressed in dB
  - e. Waveform output of the audio amplifier with a known waveform input (screenshot)
3. Waveform screenshots for the entire circuit connected as in the circuit diagram with the waveform generator used as signal source
4. Waveform screenshots for the entire circuit connected as in the circuit diagram with the muscle EMG used as signal source
5. Your analysis and interpretation of the measurements
6. A discussion of important issues you would consider when designing a single-supply EMG amplifier

**Remarks**

You can reuse any and all of the measurements, table, plots, and write ups from the reports you wrote for the intermediate lab reports on this project, but the final report should be complete as defined in the previous section.

We want you to be able to measure muscle EMG before the end of the lab experiment. If you need to choose between completing one set of data and measuring the EMG, choose the latter!