ABSTRACT

Electromyography (EMG) signals are one of the indicators of muscle activity that are widely used in biomedical engineering, especially in the control system of assistive devices such as exoskeleton robots. This study designed and developed a three-channel EMG sensor, named EMGrf 1.0, using an AD620 instrumentation amplifier as the main component, a Sallen-key bandpass filter, a full-precision rectifier circuit, and an envelope detector as a sequential analog signal conditioning circuit. designed to amplify and process surface EMG signals in realtime with a focus on the physiological frequency range of muscles (15.9–338 Hz). Signal acquisition was carried out using two methods, namely using an Arduino Uno microcontroller with a 10-bit ADC resolution, and using an Eduscope3000 digital oscilloscope for waveform verification. Sensor performance evaluation was carried out with the main parameters being the signal-to-noise ratio (SNR), the sensitivity of the signal amplification to the input, and the effective bandwidth. Test results show that EMGrf 1.0 has a significant SNR increase of 18,12 dB compared to the EMG v1.1 version which was only 5,06 dB. The gain sensitivity reached 3,18 V against 2 mV input depending on the observed muscle, close to the initial design value. All three channels successfully differentiated muscle activity between rest and contraction conditions, with the second channel's response being slightly lower and has been further analyzed.

Keywords—*Electromyography (EMG), EMG sensor, signal-to-noise ratio (SNR)*