Abstract

Electromyographic (EMG) signals have been widely employed as a control signal in rehabilitation and a means of diagnosis in health care. Signal amplification and filtering is the first step in surface EMG signal processing and application systems. The characteristics of the amplifiers and filters determine the quality of EMG signals. Up until now, searching for better amplification and filtering circuit design that is able to accurately capture the features of surface EMG signals for the intended applications is still a challenging. With the fast development in computer sciences and technologies, EMG signals are expected to be used and integrated within small or even tiny intelligent, automatic, robotic, and mechatronics systems. This research focused on small size amplification and filtering circuit design for processing surface EMG signals from an upper limb and aimed to fix the amplifiers and filters inside a robotic hand with limited space to command and control the robot hand movement. The research made a study on the commonly used methodologies for EMG signal processing and circuitry design and proposed a circuit design for EMG signal amplification and filtering. High-pass filters including second-order and fourth-order with the suppression to low frequency noises are studied. The analysis, verification and experiment showed that a second-order high-pass filter can
adequately suppress the low frequency noises. The proposed amplification and filtering circuit design is able to effectively clean the noises and collect the useful surface EMG signals from an upper limb. The experiment also clearly revealed that power line interference needs to be carefully handled for higher signal-noise-ratio (SNR) as a notch-filter might cause the loss of useful signal components. Commercial computer software such as LabView and Matlab were used for data acquisition software development and data analysis.

References

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Index Terms

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