

Amplitude independent versus amplitude dependent muscle activity detection algorithms: a comparative study

ABSTRACT

The amplitude dependent muscle activity detection algorithms of the surface electromyography (sEMG) signals are very sensitive to the changes in the background noise levels and the performance of these amplitude-based methods is highly deteriorated when the Signal to Noise ratio (SNR) of the sEMG signal is low. sEMG signals of deep and small muscles as well as sEMG signals recorded from patients that have neuromuscular diseases may not meet this SNR requirement which motivates the need for amplitude independent algorithms that can detect weak muscle activities. Moreover, the sEMG signal amplitude is not constant during the recording time due to the variation in the characteristics of the electrode-skin interface and due to the changes in the ground reference level. Therefore, the performance of the muscle activity detection algorithms should not be affected by the involuntary amplitude variations of the sEMG signal in order to achieve reliable control of robotic devices intended for disabled people. To accentuate the importance of the amplitude independent muscle activity detection methods over the amplitude dependent detection methods, a comparative study has been conducted in this paper between the performance of an amplitude independent muscle activity detection algorithm (FLA-MSE algorithm) and three amplitude dependent algorithms with respect to the detection capability of weak muscle activities and with respect to the immunity against false alarms. The results have showed that the performance of the amplitude independent algorithm outperformed the performance of the amplitude dependent algorithms for detecting weak muscle activities and for robustness against false alarms.

Keyword: Amplitude independent; False alarms; sEMG; Surface electromyography; Weak muscle activity detection