IEEE Sensors Journal, vol. 13(7), 2013, pages 2499-2516

Mechanomyography sensor development, related signal processing, and applications: a systematic review

Abstract

Mechanomyography (MMG) is extensively used in the research of sensor development, signal processing, characterization of muscle activity, development of prosthesis and/or switch control, diagnosis of neuromuscular disorders, and as a medical rehabilitation tool. Despite much existing MMG research, there has been no systematic review of these. This paper aims to determine the current status of MMG in sensor development, related signal processing, and applications. Six electronic databases were extensively searched for potentially eligible studies published between 2003 and 2012. From a total of 175 citations, 119 were selected for full-text evaluation and 86 potential studies were identified for further analysis. This systematic review initially reveals that the development of accelerometers for MMG is still in the initial stage. Another important finding of this paper is that sensor placement location on muscles may influence the MMG signal. In addition, we observe that the majority of research processes MMG signals using wavelet transform. Time/frequency domain analysis of MMG signals provides useful information to examine muscle. In addition, we find that MMG may be applied to diagnose muscle conditions, to control prosthesis and/or switch devices, to assess muscle activities during exercises, to study motor unit activity, and to identify the type of muscle fiber. Finally, we find that the majority of the studies use accelerometers as sensors for MMG measurements. We also observe that currently MMG-based rehabilitation is still in a nascent stage. In conclusion, we recommend further improvements of MMG in the areas of sensor development, particularly on accelerometers, and signal processing aspects, as well as increasing future applications of the technique in prosthesis and/or switch control, clinical practices, and rehabilitation.

Keywords — Mechanomyography, muscle characteristics assessment, prosthesis control, sensor development, signal processing.