Development of measuring system of EMG from human's leg

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ABSTRACT

In this research, EMG (Electro-Myo-Gram) signal from human's leg was selected as input of the man-machine interface. The measuring method of EMG signal and positions of electrode were examined. The measurement experiment was performed, its result was applied RMS processing and normalizing. From these EMG changing patterns of lower leg, four motions of lower leg could be discriminated clearly.

Introduction

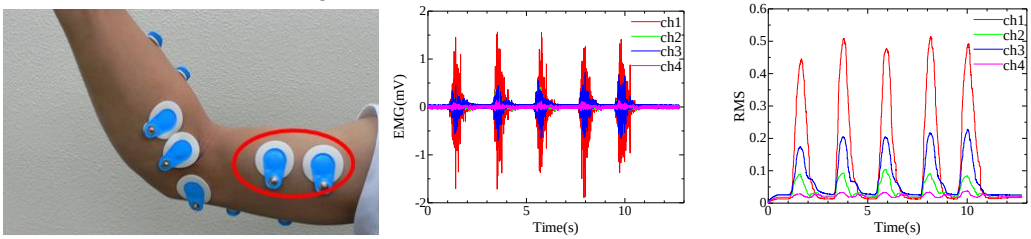
The prosthetic hand is generally used by a person who lost hand in accident. Especially, the myoelectric prosthesis is studied positively. Using EMG signal from human body except hand, it is able to support work which required both hands, and can control system without hands. Therefore, as interface for input EMG signal from human leg was selected in this research.

About EMG

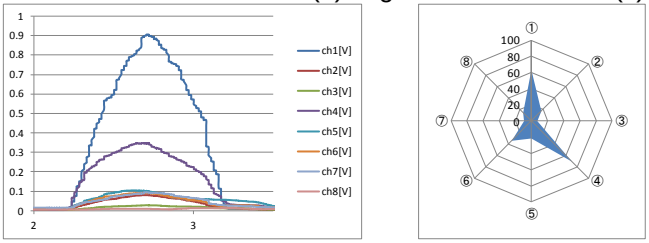
By a sent level from the cerebrum, human muscles constrict and we can do various motions. In constricting of muscle, electric potential difference occurs. It is called EMG. There are two types of measuring method, surface EMG and needle EMG. Surface EMG was selected in this research, because it is non-invasive and can measure signal dynamically. However, measured signals are affected by muscle tissue and positions of electrode. Therefore some experiments were performed, and measuring conditions were examined. EMG is AC signal, then RMS processing is applied for extraction of EMG amplitude changing pattern(Fig.1).

$$RMS = \sqrt{\frac{1}{N}\sum_{i=k}^{k+N-1} EMG_i^2}$$

N : number of data in 1 segment



(a) Electrode (b)Original data (c)RMS processing



(d)EMG pattern (e)Normalizing

Fig.1 EMG signal and processing

The measurement experiment

The measurement experiment was performed to examine the correlation of lower leg and EMG (Fig.2). EMG signal was acquired from eight positions of muscle in lower leg simultaneously. Measurement positions and motions are shown in Figs. 3 and 4. Each muscle was selected referring to medical books. All leg motions are easy with sitting. It was assumed that these six motions are one-unit, and it was measured five times in several days. Using maximum value of each EMG, datum are normalized for extraction of EMG pattern.

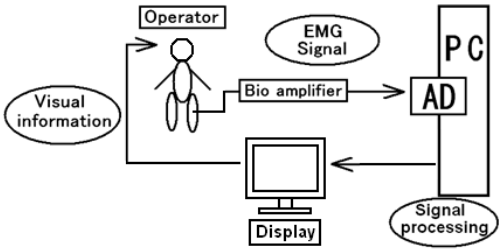


Fig.2 System using virtual simulator

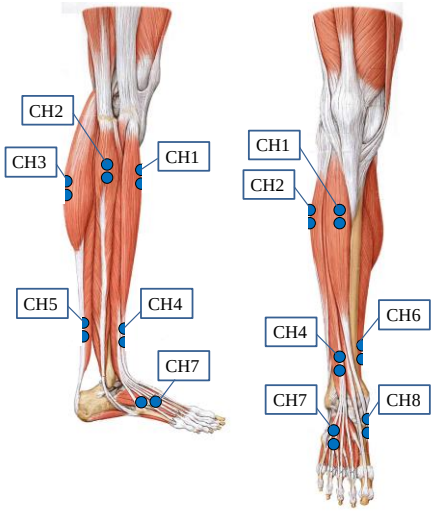
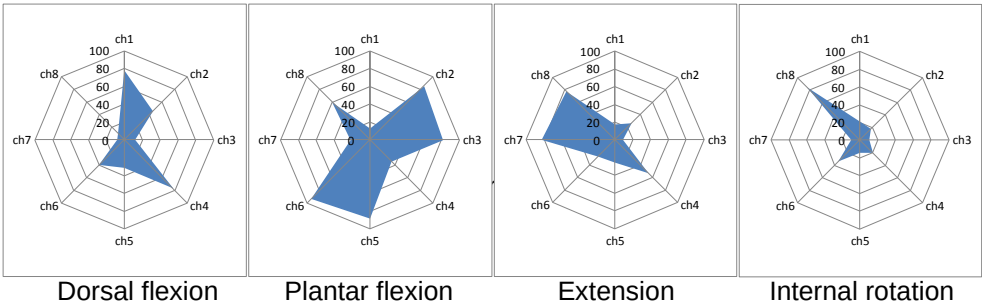


Fig.3 Measurement 8 Positions

Dorsal flexion Plantar flexion Extension Flexion External rotation Internal rotation

Results

From the measurement experiment, EMG patterns of each motion were obtained (Fig.5). These four motions can be discriminated clearly, in consideration of reproducibility.



Dorsal flexion Plantar flexion Extension Internal rotation

Fig.5 8ch EMG Radar Chat

Conclusions

Four motions were discriminated with EMG signal from lower leg. In the future, we will examine individual variation about these results, and improve accuracy of discrimination. Furthermore, we will make a system using these EMG patterns as interface of input.