Pemanfaatan Sinyal Mioelektrik (SME) Pada Proses Kontraksi Otot Sebagai Pemicu Gerak Motor Aktuator (Awal Rekayasa *Myoelectric Artificial Hand*)

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SUMMARY

The National Health Census of the Department of Health in 2001 showed that disability prevalance in Indonesia is 39%. During 2006, at Prof. Dr. Soeharso Orthophedic Hospital in Surakarta, the lower limb amputation (leg) is about 25% from all hospitals rate, whereas upper limb (arm) amputation is about 15%, consisting of 10% above the elbow and 5 % beneath the elbow.

Prosthesis application on people with dissability, as requirement, is one of the method to overcome limbs' disability. Expectably, the limb disability can be replaced with prosthesis and help those people to fullfil their daily function. Nowadays, there are 2 kinds of wellknown hand prosthesis in Indonesia, namely cosmetic acquirement prosthesis and shoulder movement based hand prosthesis which need quite a lot of energy, also providing only pincers movement. Meanwhile, myoelectric artificial hand is an artificial hand with desireable movement. The input to operate it is myoelectric from its users body. It is not neccessary for its user to have a lot of energy to operate it, just concentrate as if the user move their real hand. But the cost is very expensive and abroad dependent to invetorized.

Beyond its manufacturing, some preparation must be performed, such as fitting process to determine the location of myoelectric signal reader device and to set necessary gain so that the user is able to well operate the artificial hand, need no cheap cost. With hands grip and body fat percentage approach, MES rate of person can be estimated, because by knowing MES rate of person, hopefully artificial hand specification can be determined.

The problem is how to measure someone's MES (myoelectric signal) with surface electrode, like artificial hand to seize and turn MES become a movement, how to put the electrode and is there any correlation between MES, hands grip, dan body fat percentage. According to literature research that had been performed, there is no adequate and detailed information from those three component.

By using two electrode for the detection of MES, two active filter "-40 dB/decade Butterworth Low Pass Filter" with 6 Hz cut off frequency, Differential Amplifier and Buffer circuit, the output can be observe through osciloscope, monitor screen of

computer, and actuator motor movement after adding DC Power Amplifier. Overall, this system can be overcome inducing noise from 50 Hz. building electrical devices.

From the value of MES that measure with the seizing and processing device / system, found a reality that for a certain finger movement, there was MES value above a muscle belly that the biggest among MES from several muscle that have the same function for the movement. So further that location can be selected to seize MES in order with the desirable movement.

The amputees have enough MES and able to move the actuator motor, as long as they always do exercise their muscles.

The other result of the research is there is correlation between MES, hand grip, and body fat percentage. Measuring/searching data of those three variable involving normal hands of 20 persons. Through statistical research conclude that each variable corelate one another, both positive or negative. MES correlate positively with hand grip, but negatively with body fat percentage. Through linier regression approach, we found a mathematical formula to estimate MES value both by hand grip quantity or body fat percentage.

The result of this research can be developed to create a myoelectric artificial hand or other medical device, such as to identify the quality of muscle activities, to train muscle contraction of the patient with amputated hand before using myoelectric artificial hand, and to train the patient to maintain their health so their muscles could be at their best shape and function.

ABSTRACT

Utilization of Myoelectric Signal on Muscle Contraction Process
as Trigger for Actuator Motor Movement
(Beginning of Myoelectric Artificial Hand Engineering)

The prosthesis utilization is an alternative way that many people took to overcome handicap due to the loss of extremity during accident or any other cause. Specially for artificial hand, myoelectric artificial hand type can be functionally desireably, so it has become common interest. In Indonesia this kind of prosthesis is still rare and very expensive (import dependent). Beside of its expensive cost, the preparation cost (fitting and exercise) for its user is also quite expensive. The alternative way to suppress its cost is to provide some specification product that can be chosen as needed. Correlation between myoelectric signal (MES), hand grip, and body fat percentage are believe to be useful as foundation to determine specification product of artificial hand, which is physically measure of myoelectric artificial hand and power amplification of needed MES input. From the literature study that had been performed (specially about MES), both seizing mechanism and processing myoelectric signal, or information about correlations between MES, hands grip, and body fat percentage are still unclear.

The objective of this research is to build a MES processing device as an initial engineering for myoelectric artificial hand product, and also to seek correlation between MES, grip strength, and body fat percentage. So the hypothesis of this research is that the

processing MES device from the mechanism of muscle contraction can be built using surface electrode without external electrical stimulator, and there are significant correlation between MES, body fat percentage, and grip strength.

By using surface electrode, this device has to be able to seize MES beneath skin surface (as referrence) ranging from 30-40 mVolt, be able to filter MES out from noise (from 220 Volt/50 Hz network), reinforcing input (MES) and calibrating MES to become drawing shape or movement (mechanic). Meanwhile, testing correlation between MES, hand grip, and body fat percentage had been performed using SPSS 14 soft network. Measuring body fat percentage had been performed using skinfold measurement with Brozek Formula.

The result of this research is that MES wave reading can be performed with engineering change MES processing device. Detected MES with 150 times tension reinforcing, range from 0 to 5.63 Volt or the quality of detected MES input range from 0 to 37.53 mVolt. Actuator motor can also spin while muscle contracted, and stop spinning when muscle relaxed. In addition, there are quite significant correlation between MES, grip strength, and body fat percentage. The strongest correlation is between MES and hand grip.

In conclusion, MES processing device from muscle contraction mechanism can be build using surface electrode without external electric stimulator, and there is strong correlation between MES and grip strength, and there is moderate correlation between MES and body fat percentage.

Keywords : artificial hand, myoelectric signal, muscle contraction, hand grip, body fat percentage.