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Judul Jurnal Ilmiah (Artikel) : Anthropomorphic transradial myoelectric hand using tendon-spring mechanism
 Jumlah Penulis : 4 orang (**Mochammad Ariyanto**, Rifky Ismail, Joga D. Setiawan, Elga P. Yuandi)
 Status Pengusul : Penulis ke-3
 Identitas Jurnal Ilmiah : a. Nama Jurnal : Telkomnika (Telecommunication Computing Electronics and Control)
 b. Nomor ISSN : ISSN: 16936930
 c. Vol, No., Bln Thn : Volume 17, Issue 1, Januari 2019
 d. Penerbit : Universitas Ahmad Dahlan
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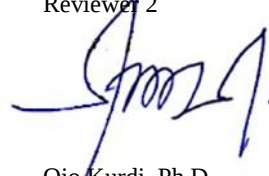
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Semarang, 1 Juni 2021
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2. Ruang lingkup dan kedalaman pembahasan:

Artikel ini menyajikan tentang desain dan pengembangan *myoelectric hand* berbasis teknologi 3D printer. Desain, kontrol yang digunakan, hasil pengujian secara eksperimental tangan bionik telah disajikan dengan jelas dan detail.

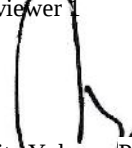
3. Kecukupan dan kemutakhiran data/informasi dan metodologi:

Jurnal yang ditulis mempunyai tingkat kemutakhiran yang cukup baik dari segi desain dan control yang menghemat energi baterai. Hasilnya menunjukkan bahwa tangan *myoelectric* yang diteliti siap digunakan untuk penyandang disabilitas tangan.

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2. Ruang lingkup dan kedalaman pembahasan:

Paper ini membahas tentang kontrol tangan bionik. Pembahasan dilakukan secara mendalam. Gambar dan hasil ditampilkan secara menarik.

3. Kecukupan dan kemutakhiran data/informasi dan metodologi:

Tangan bionik yang diusulkan mempunyai novelty yang sudah bagus. Metode ditulis dengan detil dan runtut. Diagram alir juga ditampilkan dengan lengkap. Pustaka yang digunakan juga terbaru pada saat jurnal diterbitkan.

4. Kelengkapan unsur dan kualitas terbitan:

Kualitas paper cukup baik dengan mempertimbangkan unsur-unsur penyusun jurnal. Jurnal termasuk Q3 dengan SJR 0.21 saat paper ini terbit.

Semarang, 1 Juni 2021

Reviewer 2

Ojo Kurdi, Ph.D

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Anthropomorphic transradial myoelectric hand using tendon-spring mechanism

Ariyanto M. ✉ , Ismail R., **Setiawan J.D.**, Yuandi E.P.

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Abstract

In the developing countries, the need for prosthetic hands is increasing. In general, transradial amputee patients use prosthetic hands that are passive like a body-powered prosthesis. This research proposes a low-cost myoelectric prosthetic hand based on 3D printing technology. Hand and finger size were designed based on the average size of human hands in Indonesia. The proposed myoelectric hand employs linear actuator combined with the tendon-spring mechanism. Myoelectric hand was developed with five modes of grip pattern to perform various objects grasping in activity of daily living. Control strategy had been developed for controlling the motion of flexion and extension on the

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Arduino-based myoelectric control: Towards longitudinal study of prosthesis use

Wu, H. , Dyson, M. , Nazarpour, K.
(2021) *Sensors (Switzerland)*

Affordable and faster transradial prosthetic socket production using photogrammetry and 3d printing

Ismail, R. , Taqriban, R.B. , Ariyanto, M.
(2020) *Electronics (Switzerland)*

Two-chambers soft actuator bending and rotational properties for underwater application

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(2019) *Indonesian Journal of Electrical Engineering and Computer Science*

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Ariyanto, M. , Ismail, R. , Mustaqim, K.A.
(2017) *International Journal of Mechanical and Mechatronics Engineering*

Development of Myoelectric Prosthetic Hand based on Arduino IDE and Visual C# for Trans-radial Amputee in Indonesia

Ismail, R. , Wijaya, G.D. , Ariyanto, M.
(2018) *Proceedings of the 2018 International Conference on Applied Engineering, ICAE 2018*

Design and development of wireless operated low cost prosthetic hand by fused deposition modeling

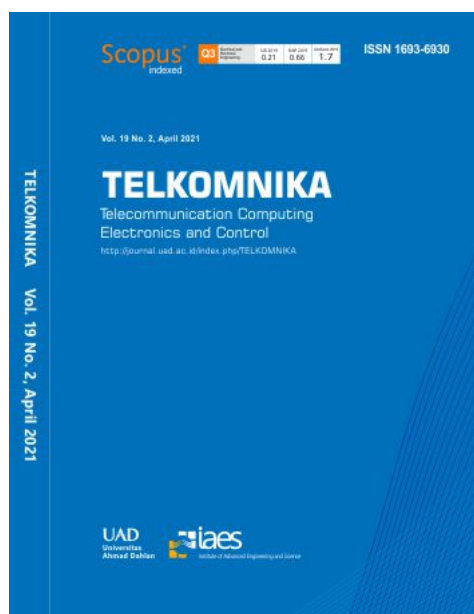
Venkatesh, B. , Ajay Kumar, M.

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Vol 17, No 1

February 2019

DOI: <http://dx.doi.org/10.12928/telkomnika.v17i1>

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TELKOMNIKA Telecommunication, Computing, Electronics and Control

ISSN: 1693-6930, e-ISSN: 2302-9293

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Anthropomorphic transradial myoelectric hand using tendon-spring mechanism

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Abstract

In the developing countries, the need for prosthetic hands is increasing. In general, transradial amputee patients use prosthetic hands that are passive like a body-powered prosthesis. This research proposes a low-cost myoelectric prosthetic hand based on 3D printing technology. Hand and finger size were designed based on the average size of human hands in Indonesia. The proposed myoelectric hand employs linear actuator combined with the tendon-spring mechanism. Myoelectric hand was developed with five modes of grip pattern to perform various objects grasping in activity of daily living. Control strategy had been developed for controlling the motion of flexion and extension on the hand and saving the energy consumed by the actuators. The control strategy was developed under MATLAB/Simulink environment and embedded to Arduino Nano V3 using Simulink Support Package for Arduino Hardware. Surface electromyography (EMG) sensor was used in this research for reading the muscle activity of the user/wearer. The proposed myoelectric hand had been tested in object grasping test and was implemented on a study participant with transradial amputee.

Keywords: 3D printing, low-cost, myoelectric, prosthetic hand, tendon-spring

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1. Introduction

Myoelectric prosthetic hand is a wearable robot that resembles human hands and can move like a human hand such as taking, grasping, holding, and putting an object. Due to limitations in performing activity of daily living by a handicapped person, the myoelectric prosthetic hand becomes a device needed by handicapped persons. With a myoelectric prosthetic hand, people with disabilities can be helped in carrying out their normal activities. In developing countries, the widely used prosthetic hands are still passive prosthetic hand or body-powered prosthetic hand. Recently, the myoelectric hand manufacturers that are available in the market today include Bebionic [1], iLimb hand [2], Michelangelo hand [3], and Vincent Hand [4]. These hands are high-end products of myoelectric hands and have great performance and reliability. These prosthetic hands are highly expensive for people in developing and underdeveloped countries. The hands employ tendon and linkage as the joint connection to the actuator. DC motor is widely used in the myoelectric hand as an actuator. The myoelectric prosthetic hand also incorporates non-backdrivable mechanism to maintain high grip forces without consuming current from battery [5].

Currently, low-cost myoelectric prosthetic hands based on 3D printing technology are available on the market. The low-end product based on 3D printing technology of myoelectric hand is proposed for achieving the affordable hands and lightweight. The commercially available low-cost myoelectric prosthetic hands are Ada Hand [6], Dextrus hand from Open Hand Project [7], Exiii Hackberry [8], and Brunel Hand from Open Bionics [9]. These hands employ tendon mechanism and DC motor [6, 7], [9] for actuating the flexion and extension of the fingers. While Exiii Hackberry uses linkage and servo motor. Researchers in universities have developed myoelectric prosthetic hand by using 3D printing technology. The material used for the hand will be affordable and lightweight. The studies of myoelectric prosthetic hands based on 3D printing have been proposed by some universities such as Tact [10], Rehand [11], Smart Hand [12], Keio Hand [13], AstoHand [14, 15], UC SoftHand [16], ISR-SoftHand [17], and other prosthetic hands [16-22]. The mass of the hands on those research works are less than 500 grams.

Research, design and fabrication of a microwave active filter for nanosatellite's receiver front-ends at s-band

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Abstract

In satellite technology, the communication between space segment and ground segment plays a vital role in the success of the mission. This paper is targeted at study, design and fabrication of a microwave active filter for the receiver front-ends using coupled line filter structure, which can be applied to the nanosatellite's communication subsystem. The whole active filter module is a combination of a microstrip bandpass filter and a preceding two-stage wideband low noise amplifier using FET devices. The proposed module operates in the frequency range of 2-2.4 GHz, which can be divided to 10 frequency slots of about 40 MHz for each. These frequency slots will be used for the S-band multi-frequency receiving function of the ground station, as well as the nanosatellite. The simulated and measured results of this active filter configuration are presented.

Keywords: coupled line bandpass filter, microwave active filter, nanosatellite, receiver front end, wideband low noise amplifier

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1. Introduction

Small satellites have been widely applied in communications satellite in recent years. In this section, nanosatellite is being regarded as a proper choice for satellite communication in developing countries, because of its low fabrication budget, ability of integrating numerous in a single launch vehicle, and the possible of arranging in constellation for *in-situ* operation. The wet mass of a typical nanosatellite lies between 1 and 10 kg, and its dimensions seldomly exceed 30 cm. The performance of receiver system for nanosatellite missions is mainly governed by the bandpass filter (BPF) and low noise amplifier (LNA) units. Without these parts, the receiver is unable to distinguish the weak receiving signal from the noise. Consequently, the bit error rate (BER) will increase drastically and certainly lower the quality of the receiving message. Therefore, designing good filtering and low noise amplifying modules are prime requirements of a success communication mission.

In the filter region, there are four major parameters govern the dissipation loss level of a bandpass filter: The filter type, the order of the filter, the unloaded Q-factor of the filter elements and the bandwidth. Universally, all passive bandpass filtering structures encounter a problem of compromising between insertion loss and bandwidth, especially at radiofrequency. For details, the product of these two parameters is a constant [1], a narrower bandpass filter means higher degree of insertion loss. Furthermore, in microwave frequencies, it is really a challenge to construct a high-performance filter with passive elements only, because of the detrimental effects of the parasitic elements. Electronics researchers have taken many efforts to deal with these problems for decades, and thanks to the development of the semiconductor technology, a very promising solution for this limitation is established: Using field effect transistors (FET) as active elements to compensate the insertion loss while maintaining the bandwidth quality of the filter. The system consists of the microwave filter and the active element, which is the LNA in our case, is called Microwave Active Filter (MAF). The receiving signals first go through a bandpass filter, which lies outside the MAF unit, for a primary filtering process. This filter is necessary because the raw receiving signal is very noisy and contains some amplitude perturbation superimposing components, which can lead to an overload in the LNA. Figure 1 shows the block diagram of a receiver system including the MAF unit:

Nature grasping by a cable-driven under-actuated anthropomorphic robotic hand

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Abstract

Human hand is the best sample for humanoid robotic hand and a nature grasping is the final target that most robotic hands are pursuing. Many prior researches had been done in virtual and real for simulation the human grasping. Unfortunately, there is no perfect solution to duplicate the nature grasping of human. The main difficulty comes from three points. 1. How to 3D modelling and fabricate the real hand. 2. How actuated the robotic hand as real hand. 3. How to grasp objects in different shapes like human hand. To deal with these three problems and further to provide a partial solution for duplicate human grasping, this paper introduces our method to solve these problems from robotic hand design, fabrication, actuation and grasping plan. Our modelling progress takes only around 12 minutes that include 10 minutes of 3D scanning of a real human hand and two minutes for changing the scanned model to an articulated model by running our algorithm. Our grasping plan is based on the sampled trajectory and easy to implement for grasping different objects. Followed these steps, a seven DOF robotic hand is created and tested in the experiments.

Keywords: 3D modelling, cable-driven, grasping plan, kinematics, motion control

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1. Introduction

Human hand has 21 Degree of Freedom (DOF) for five fingers. However, due to the cost and complexity, almost all of the existing robotic hand [1, 2] are under-actuated [3] robotic hand which has less than 21 actuators. Cable driven is a common and simple actuate solution to control the under-actuated robotic. The cable-driven under-actuated robotic hand usually has a limited motion range which very different from the real hand. Thus there is not much prior research on the kinematic of it. Human grasping is the perfect combination of speed, accuracy and strength. The development of robotics and virtual reality has promoted the research of human hand movement. Since the first appearance of Virtual Humans in the early 1980s, many types of research related to grasping plan have been conducted in a virtual environment [4, 5]. As hand is the most flexible part of the human body [6], the unique structural features and cognitive factors of the brain determine the complexity of its movement. At present, the research on human hand grasping is particularly prominent in the field of humanoid robot [7-9]. The researchers found that the joints of the human joints were in motion with certain movement rules and could be used to control the grasping of multiple fingers. In the virtual hand research, Rezzonico et al first defined this motion rule as automatic grasping, and grabbed it into two categories: automatic grasping and interactive grasping. They also proposes a general framework to enhance grasping interactions [10]. Further research about individual robotic hand kinematics can be found in [11-13].

With the help of 3D scanning and 3D printing technologies, we model our robotic hand based on a real hand's 3D scanning model. We create an algorithm to convert this scanned 3D mesh model into an interlocked articulated 3D model. Next we printed out 3D model as shown in Figure 1 (A) and test it with seven strong but tiny servo motors. The size and weight of the motors are 20x18x30 mm and 12.7 grams. At last we analyze the trajectory of each finger and provide grasp plan to a basic grasp gesture, Tripod grasp. Figure 1 shows our robotic hand, Nadine hand version 3. Our previous study of robotic hand can be found in [14-16].

In this paper, we first created a new cable-driven under-actuated robotic hand by 3D modelling and 3D printing. Normally the trajectory of the cable-driven robotic hand is not easy to acquire as the uncertainly during build the cable driven system. So we provide a new method to