EMG-Adaptive Prosthetic Hand with Enhanced Tactile Feedback

Principal Investigators

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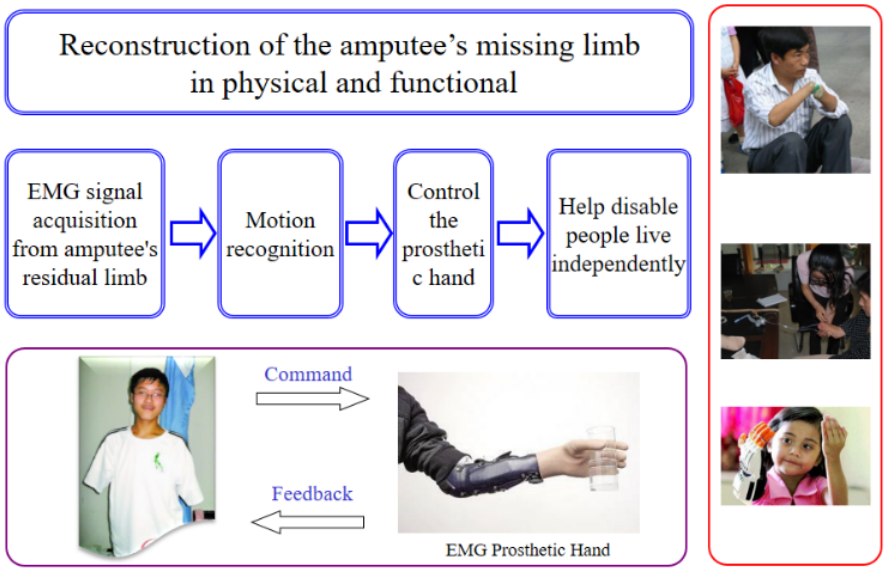
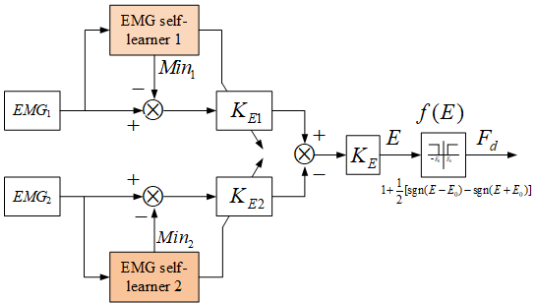
Introduction

A large number of people around the world are physically disabled due to various causes, such as war and traffic accidents. The loss of a limb seriously affects their quality of life. Prosthetic hands are used to replace amputees' missing limbs in terms of appearance and function, aiming to rebuild hand function.

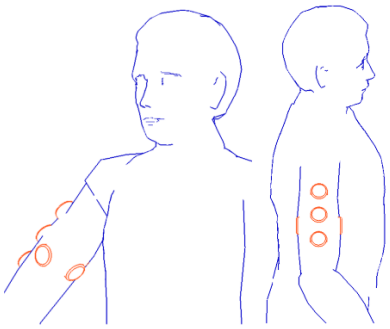
EMG prosthetic hands use the electrical signals from the human skin surface as a control signal, offering natural movement and familiar operation, and attracting widespread interest. However, EMG signals exhibit strong individual differences, and these signals can vary when EMG sensors are placed in different positions. Due to these factors, control parameters must be customized for each individual when they begin using a prosthetic hand. Additionally, adapting to prosthetic hands often requires a long period, and the lack of tactile sensing can leave the control effect unsatisfactory.



This project introduces a method for adaptive learning of EMG signals, which dynamically adjusts control parameters based on the wearer's EMG signals, enabling people with disabilities to use the prosthetic hand flexibly and freely in a short period of time. To enhance the sense of proprioception, the project also utilizes tactile feedback technology, allowing both the controller and wearer to perceive the grasping state of the prosthetic hand in real time, thereby improving control and making the hand controllable and perceptible.



Adaptive learning of EMG signals



Tactile feedback technology

Special Features and Advantages

- Control parameter can be adjusted automatically according to the users' EMG.
- Sensor mechanical integrated finger can detect grasp force and stress location.
- Tactile representation helps the users perceive the statue of the prosthetic hand.
- Grasping force and the speed of opening and closing are controllable following the user's intention.

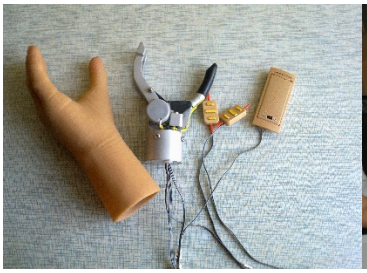
Intellectual Property

Our projects have achieved breakthroughs in EMG motion recognition, prosthetic hand motion control, and tactile perception, among other areas, and have obtained comprehensive intellectual property protection.

- Adaptive EMG motion recognition method: PRC Patent ZL2019104519142 Copyright 2018SR474545
- Grasping force control method: Copyright 2018SR940664
- Mechanical sensor integrated finger: PRC Patent ZL201810189329.5, ZL201910449087.3
- Tactile feedback method: PRC Patent ZL201820316122.5, Copyright 2018SR289394

Applications

The project has been implemented for small-scale production and sales at the Danyang Prosthetics Factory, with over 500 individuals now using the myoelectric prosthetic hands developed.



Awards

This project has received the Gold Award from the Moscow "Archimedes" International Invention Exhibition and the "Technology Innovation Award" from the Jiangsu Province Artificial Intelligence Society in China.

Gold Award

Technology Innovation Award