主 論 文 の 要 旨

論文題目　Intention Reading and Sensory
Substitution for Improving Walking
Quality of Paraplegia Wearing An
Exoskeleton
(両下肢麻痺患者の歩行支援を改善する意
図推定と感覚代行技術)

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論 文 内 容 の 要 旨

People with the lower limb paralysis have lost their motor and sensory functions of the lower body, and have suffered from various complications for a long time. The powered lower-limb exoskeleton brings hope to the patient's walking again, but its movement trajectory is preset and it does not provide feedback on the walking status such as stride and height. In addition, the exoskeleton does not contribute to balance maintenance while walking, and the patient has to hold a pair of cane to keep balance. This article contributes to improve the existing powered lower-limb exoskeleton system from the three aspects so that the paraplegic patient wearing exoskeleton can walk stably according to his/her intention. The three aspects are 1) Walking control interface. The walking control interface is installed at the handle of the cane. While not affecting the use of the cane, the patient can control the gait through the index finger. 2) Electrical stimulation feedback. The portable electrode plate is tied to the finger, and the user recognizes the stride and height by identifying the stimulation pattern. 3) Walking stability improvement. Gait modification based on ZMP and nonlinear inverted pendulum model, improve the stability of walking, and enable the exoskeleton to participate in maintaining the balance of walking. The three methods proposed in this paper were verified by robot walking experiment and Gazebo simulation. The

experimental results show that the electric stimulation feedback used for position prompting can achieve the same accuracy as the visual feedback. After gait modification, average ZMP tracking error is reduced by 44%.