

システム情報工学研究科修士論文概要

年 度	平成 24 年度	学位名	修士(工学)
専 攻	知能機能システム	専攻	著者氏名 Modar HASSAN
指導教員氏名 鈴木 健嗣			
論文題目 Exoskeleton Robot Control based on Whole Body Posture with Walking Aid (歩行補助具と全身姿勢に基づく外骨格型ロボット制御)			
論文概要 <p>Current robot control systems for the lower limbs exoskeleton focus mainly on the lower limbs, and the upper-lower limbs coordination in human locomotion is not considered. This approach overlooks that human bipedal locomotion is based on quadrupedal limb coordination, and also overlooks motion intention estimation from the upper limbs.</p> <p>In this research we propose a novel method for lower limbs exoskeleton robot control based on whole body posture (upper and lower limbs) to benefit from the upper-lower limbs coordination in the interface between human and exoskeleton robot. We have developed the sophisticated control system based on inter-limb coordination of locomotion in healthy, stroke, and Spinal Cord Injury patients. The proposed method utilizes the cane (walking aid) with several sensors such as ground contact and gyroscope in order to obtain the upper limbs movement. Since we propose to use the cane in the motion intention estimation process, we first conduct gait analysis with cane on healthy subjects walking with and without a cane. The synergies analysis shows that for the motion of lower limbs, cane and lower limbs, and upper and lower limbs four synergies explained about 95% of the movement. We therefore conclude that the cane could be used in a synergies based control system. We then developed a control system for single leg version of the Robot Suit HAL (Hybrid Assistive Limb) based on the proposed method and implemented it with a motion capture system and with a wearable system based on inertial sensors. The implementation shows that the proposed approach is verified, and it is possible to control the exoskeleton robot based on the upper and lower limbs synergies, and the cane can be used in the suggested scenario as well.</p> <p>This research is based on the reported benefits of using the cane on postural control and augmentation of somatosensory feedback for balance control. The achievement contributes to the technology for cognitively assisted locomotion, which helps physically challenged people to walk in a natural manner.</p>			
審査日	平成 25 年 1 月 31 日		
審査員	(大学名 職名)	(学位)	(氏名)
主査	筑波大学 准教授	博士(工学)	鈴木 健嗣
副査	筑波大学 教授	工学博士	山海 嘉之
副査	筑波大学 准教授	博士(工学)	長谷川 泰久