氏　名	李　想
授与した学位	博　士
専攻分野の名称	工　学
学位授与番号	博甲第　　５９７２　　号
学位授与の日付	平成３１年　３月２５日
学位授与の要件	自然科学研究科　　産業創成工学　専攻 （学位規則第４条第１項該当）
学位論文の題目	Motion Control and Applications by Stereo-vision-based Servoing－Centering on Humanoid Robot－ （ステレオビジョンサーボによる運動制御と応用－ヒューマノイドロボットを中心として－）
論文審査委員	教授　見浪　護　　教授　神田　岳文　　准教授　松野　隆幸

学位論文内容の要旨

Biped locomotions created by controlling based on Zero-Moment Point (ZMP) have been realized in real world and been well verified its efficacy for stable walking. In this thesis, a dynamical model of humanoid robot composed of seventeen links is proposed as the first step, which is derived by the Newton-Euler method. To confirm the veracity of the derived dynamical model, the model has been verified from the viewpoints that when all friction coefficients are identical to zero, the total kinetic energy should be conserved to be unchanged, and when the coefficients are not zero, the total kinetic energy should decrease monotonously.

The walking strategies that have been proposed so far seem to have avoided such considerations as slipping of foot, even though there should exist the slipping large or small in real world. Biped walking based on ZMP has been known as reliable and stable control method, but it looks different from humans' walking on the view points that ZMP-based walking does not include toe-off falling state, and it is like monkey walking because of knee-bended walking. As the second step, a walking model of humanoid robot including falling state, slipping, bumping, surface-contacting and line-contacting of foot is proposed.

The humans' walking control utilizes kicks by toes, which means toe-off falling state, then it is vulnerable to turnover. Such walking profile－we call it dynamical walking－has been set as a research direction of this research. Therefore, keeping the walking of dynamical motion stable is indispensable issue for realization of human-like walking. "Visual Lifting Approach" (VLA) strategy inspired from the humans' walking motion that makes use of visual perception has been proposed in order to enhance robust walking and prevent the robot from falling down. The VLA is composed of visual lifting feedback and feedforward of walking gate generation. This thesis confirms that the bipedal walking including slipping state between foot and floor converges stable limit cycle by proposed VLA strategy.

論文審査結果の要旨

Biped locomotion based on Zero-Moment Point (ZMP) has been realized in real world and been well verified to be effective for stable walking. In this thesis, a dynamical model of humanoid robot composed of seventeen links is proposed as the first step, which is derived by the Newton–Euler method. To confirm the veracity of the derived dynamical model, the model has been verified from the viewpoints that when all friction coefficients are identical to zero, the total kinetic energy should be conserved to be unchanged, and when the coefficients are not zero, the total kinetic energy should decrease monotonously.

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It has been judged that the applicant satisfies the qualification condition for doctor degree in Engineering of the Graduate School of Natural Science and Technology at Okayama University.