The Motion Planning and Control of the Biped Robot

賴信成、林志哲

E-mail: 9222210@mail.dyu.edu.tw

ABSTRACT

In general, the motion planning problem of the biped robots is solved by the geometric method and etc. The geometric method can solve the inverse kinematics problem, but it can not solve the motion planning problem with task-priority and the singularity problem. In fact, the motion planning problem of the biped robots can be considered as the one of the redundant robot. The inverse kinematics problem with mechanical redundancies has historically been solved using the Moore-Penrose pseudo-inverse method; however, it has the singularity problem. In this paper, the optimal perturbation method is used to solve the motion planning problem of the biped robot. In this paper, a motion planning problem of the biped robot with 7 D.O.F. is considered; the initial and final positions of the biped robot are at the singular position. The locomotion of the biped robot is designed as the two types: statically stable walking and dynamically stable walking. The motion planning problem is formulated as an optimal problem with the inequality constraints and the equality constraints. The constraints of joint positions are considered as the inequality constraints and the forward kinematics are the equality constraints. According the selection of the different cost function, the proposed method can achieve different task-priority problems with singularity robustness. The dynamic equation of the biped robot at the single-leg-support position is derived by the Lagrange ’ s equation. Then, the computed-torque method and the sliding-mode control method are applied to solve the trajectory tracking problem and the simulation results validate the proposed method.

Keywords : biped robot ; motion planning ; singularity problem

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