A Turning Strategy of a Multi-Legged Locomotion Robot

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1. Introduction

Locomotion with legs allows a robot to move on a rough terrain. Moreover, locomotion with many legs has the advantage to improve the stability because the robot is supported with many legs. But it also has the drawback to lack the maneuverability of locomotion because the robot is constrained on the ground by many legs. From the practical view point, it is important to study how to improve the maneuverability of a multi-legged locomotion robot. Now the established method to control a robot consists of motion planning and motion control. Motion planning is to compute the motions of the joints so as to realize a given motion of the robot, and motion control is to control the joints so as to realize the designed motion. Motion planning of the turning walk of a multi-legged locomotion robot is to compute the positions of the tips of the legs so that the robot moves along a given curved line, and this results in the inverse problems of the equations of motion for many variables. This calculation is not efficient, and the solutions can not adapt to the change of the environment.

In ethology, research on arthropod locomotion is progressed. Arthropod locomotion has much stability and also maneuverability such as quick turning. Now, research is focused to reveal what mechanism of arthropod can make the locomotion stable and maneuverable[1]. Schmitt[2], et al. have analyzed the dynamics of the turning behavior of the cockroach *Blaberus discoidalis* based on a mathematical model and revealed that the cockroach decreases the stability of a straight walk by moving the points on the body where the forces from the ground acts and this, in turn, can make the cockroach turn quickly.

In the preceding researches on robotics, there is little research of locomotion to enhance the maneuverability of motion of a robot by changing the dynamic characteristics of the robot. This paper deals with turning strategy of a multi-legged locomotion robot. We propose the control strategy for the robot so as to realize to turn efficiently by decreasing the stability of the straight walk of the robot. We have already proposed the locomotion control system of a multi-legged locomotion robot using oscillators. In this paper, the robot with this control system is subject of investigation. First, we analyze the stability of the straight walk of the robot with the proposed control system. The analysis reveals that by changing a certain control parameter, the stability of the straight walk of the robot decreases and beyond a critical point the meandering motion appears. We develop the control strategy for the multi-legged locomotion robot to turn efficiently using the change of the dynamic characteristics of the robot. The effectiveness of the turning strategy is verified by the numerical simulations; the robot can turn with less slip to the ground by decreasing the stability of the straight walk of the robot.

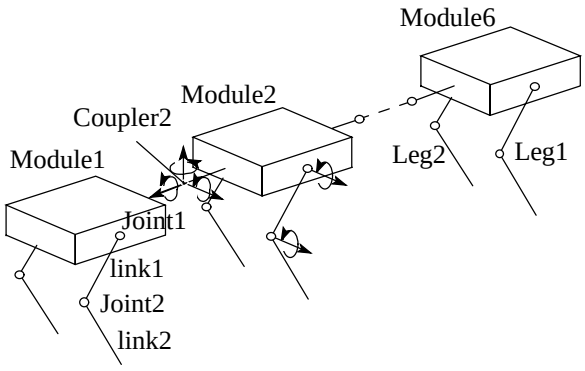

Figure 1: Schematic model of multi-legged locomotion robot

References

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