CHAPTER II

LITERATURE REVIEW

2.1 3D Modeling of a Rocker-Bogie Robot

In early stage, research in the area of mobile robot has been limited to robots moving on flat and smooth terrain [2], which based on motions in 2 dimensional with 3 degrees of freedom (X, Y and rotation about Z axis). The mobility of a rocker-bogie robot has been developed by modeled as a planar system [3]. The problems associated with high mobility robot operating in 3D terrain have not been addressed. Development of a kinematics model for the Rocky 7, rocker-bogie styled robot, is presented by M.Tarokh, G.McDermott, S.Hayati and J.Hung [4]. Using the Denavit-Hartenburg notation, forward kinematics and inverse kinematics for wheels velocities can be derived. A geometric approach is proposed to determine steering angle for each steering wheel.

2.2 Traction Control

In rough terrain, it is critical for mobile robots to maintain maximum traction. Wheel slip could cause the robot to lose control and trapped. Traction control for low-speed mobile robots on flat terrain has been studied by D.B.Reister, M.A.Unseren [5] using pseudo velocity to synchronize the motion of the wheels during rotation about a point. Sreenivasan and Wilcox [6] have considered the effects of terrain on traction control by assume knowledge of terrain geometry, soil characteristics and real-time measurements of wheel-ground contact forces. However, this information is usually unknown or difficult to obtain in practice. Quasi-static force analysis and fuzzy logic algorithm have been proposed for a rocker-bogie robot in 1998 by H.Hacot [7].

Knowledge of terrain geometry is critical to the traction control. A method for estimating wheel-ground contact angles using only simple on-board sensors has been proposed [8]. A model of load-traction factor and slip-based traction model has

been developed [9]. The traveling velocity of the robot is estimated by measure the PWM duty ratio driving the wheels. Angular velocities of the wheels are also measured then compare with estimated traveling velocity to estimate the slip and perform traction control loop.

This research developed a kinematics modeling for a rocker-bogie robot using the method the same as Rocky 7, but different in the steering configuration, there are also some modifications in the rocker and bogie link geometry. The wheel-ground contact estimation also included in the model. Then, traction control is implemented with onboard accelerometer to compute traveling velocity instead of estimating from PWM duty ratio as before.