International Journal of Innovative Computing, Information and Control
Volume **3**, Number **2**, April **2007**

 ISSN 1349-4198
pp. 353–369

DYNAMICAL MODEL OF MOBILE ROBOT INCLUDING SLIPPING OF CARRYING OBJECTS

Mamoru Minami

Department of Human and Artificial Intelligence Systems
University of Fukui
3-9-1, Bunkyo, Fukui 910-8507, Japan
minami@rc.his.fukui-u.ac.jp

Takeshi Ikeda

Department of Intelligent Machinery and Systems
Kyushu University
744, Motooka, Nishi-ku, Fukuoka 819-0395, Japan
ikeda@mech.kyushu-u.ac.jp

Motoya Takeuchi

TOKAI RIKA CO., LTD
3-260, Toyota, Oguchi-cho, Niwa-gun, Aichi, Japan

Received March 2006; revised July 2006

Abstract. *Force and torque induced by the traveling motion of a mobile robot dynamically affects the objects being carried on it. If the induced inertia force and torque are larger than the static friction force and torque, the carried objects begin to slip on the mobile robot. The final objective of this research was to construct a guidance controller that could travel as quickly as possible and prevent the carried objects from slipping. To achieve this, we modeled a mobile robot carrying plural objects to analyze their slipping motions and the influence slipping had on the traveling motion. The results of simulations were compared to actual slipping results obtained from experiments using a real mobile robot. The agreement between simulated and experimented results indicated that the proposed model could correctly describe the motion of the mobile robot carrying objects.*

Keywords: Mobile robot, Dynamical model, Carried object, Slipping object

1. **Introduction.** Robots have played an important role in various kinds of factories in recent years. They have been utilized in factories to construct effective production systems, and to promote automation and unmanned production. However, many industrial robots in practical use are fixed to the floor, limiting their areas of operation. If they had the ability to move freely, their operational area could be expanded. A further distinctive feature of mobile robots is that they can move to places where jobs are required to be done according to task demands by the total production control system. This feature increases their operational rate.

Motion of a mobile robot is dominated by dynamics and kinematics, which is referred as "non-holonimic constraint". In previous research, Muir [1] formulated a kinematical model of a wheeled mobile robot, and dynamical models have also been proposed [2-4].