

ADAPTIVE CONTROL METHOD FOR PATH-TRACKING CONTROL OF AN OMNI-DIRECTIONAL WALKER COMPENSATING FOR CENTER-OF-GRAVITY SHIFTS AND LOAD CHANGES

REN PENG TAN¹, SHUOYU WANG¹, YINLAI JIANG¹, KENJI ISHIDA²
MASAKATSU G. FUJIE³ AND MASANORI NAGANO⁴

¹School of Systems Engineering
Kochi University of Technology
No. 185, Miyanokuchi, Tosayamada, Kami, Kochi 782-8502, Japan
138003t@gs.kochi-tech.ac.jp; { wang.shuoyu; jiang.yinlai }@kochi-tech.ac.jp

²Department of Physical Medicine and Rehabilitation
Kochi University
2-5-1 Akebono-cho, Kochi 780-8520, Japan
ishidake@kochi-u.ac.jp

³Department of Modern Mechanical Engineering
Waseda University
59-309, 3-4-1 Okubo, Shinjyuku, Tokyo 169-8555, Japan
mgfujie@waseda.jp

⁴Soai Co., Ltd.
266-2 Shigekura, Kochi, Kochi 780-0002, Japan

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ABSTRACT. *In previous studies, an omni-directional walker was developed for walking rehabilitation. Walking training programs are stored in the walker so that rehabilitation can be carried out without a physical therapist. However, the walker sometimes strays from the predefined path because of center-of-gravity shifts and load changes. It is necessary for the walker to precisely follow the paths defined in the walking training programs to guarantee the effectiveness of rehabilitation and user safety. Therefore, this paper describes a path-tracking control method for the omni-directional walker to compensate for center-of-gravity shifts and load changes. First, the kinematics and kinetics of the omni-directional walker motion are presented. Second, an adaptive control strategy is proposed. Finally, simulations show that the walker can be controlled accurately by using the proposed method.*

Keywords: Omni-directional walker, Adaptive control, Load change, Center-of-gravity shift, Path tracking

1. **Introduction.** In an aging society with a low birthrate, such as that found in Japan, an increasing number of people suffer from walking impairments due to illness or accident. Therefore, the demand for walking rehabilitation has been increasing in recent years. However, Japan has a serious shortage of physical therapists. Therefore, developing a walking training machine that can efficiently conduct a variety of training programs is highly desirable.

Walking is a complex combination of motions [1], which includes not only forward and backward motions, but also right and left motions, oblique motions and rotations. Thus far, walkers for walking rehabilitation have only allowed a few basic motions with the help of crutches, canes, and parallel bars. This holds true for lift walkers [2], active walkers [3], the SRC walker (Arizono Orthopedic Supplies Co., Japan) and the posture control walker