

Design and Control of a PEMFC Powered Electric Wheelchair

Fu-Cheng Wang and Yu-Shu Chiang

Abstract

This paper proposes the design and control of a fuel-cell powered wheelchair. Electric wheelchairs can improve moving ability for people with walking problems. However, their traveling distances are limited by the capacity of their batteries. We designed a fuel-cell powered electric wheelchair that can be continuously operated, thereby extending the moving range. The system consisted of three subsystems: a commercial electric wheelchair, a proton exchange membrane fuel cell (PEMFC), and two secondary battery sets. The study was carried out in three parts, investigating the fuel-cell control, power management, and system integration. First, we designed multivariable robust controllers for a 500 W PEMFC system to charge the battery sets by constant voltage/current. Second, we designed a serial power management system, where the wheelchair motors were directly driven by the secondary battery sets, which in turn were charged by the PEMFC when their capacities dropped below a certain level. Lastly, we integrated the three subsystems and verified the system performance by experiments. The results confirmed the effectiveness of the PEMFC system as a way to extend the traveling distance of a motorized wheelchair.