2016 International Journal of Hydrogen Energy

The Development and Optimization of Customized Hybrid Power Systems

Fu-Cheng Wang* and Han-Che Chen

Abstract

This paper develops a hybrid power model that can be used to optimize customized systems. We build the hybrid model in Matlab/SimPowerSystem™, which consists of a proton exchange membrane fuel cell, a Li–Fe secondary battery set, photovoltaic (PV) arrays, and a chemical hydrogen production system. Based on experimental data, we adjust the model parameters and show that the simulation model can correctly predict the experimental responses, with a root-mean-square error of 0.6% in state-of-charge. Therefore, we can apply the model to optimize the design of customized power systems. We consider three load profiles: the lab, the department office, and the household, and modify the sizes of the PV arrays and battery capacities to optimize the system cost for each load. In addition, we analyze the impacts of power management on the system cost. The findings indicate that the developed hybrid power model is effective at estimating system responses, and can significantly reduce the time and cost for developing customized power systems.