Optimization of a polymer electrolyte membrane (PEM) fuel cell system

한인수†, 정창복[1], 박상균[2]
GS칼텍스 기술연구소; [1]전남대학교; [2]한국해양대학교
(ishan1969@gscaltex.com†)

An operation optimization method and its application to an actual PEM fuel cell system were demonstrated. A constrained optimization problem was formulated to maximize the efficiency of a fuel cell system by incorporating practical models derived from actual operations of the fuel cell system. Empirical and semi-empirical models for most of the system components were developed based on artificial neural networks and semi-empirical equations. Model validations results showed that the developed models had satisfactory predictive performance for the optimizations. Sensitivity analyses were carried out to elucidate the effects on the system efficiency of the major operating variables. Optimizations of the fuel cell system were performed to seek the best operating conditions and were verified by comparing the expected optimal values with the measured ones. The optimization results showed that the efficiency gaps between the best and worst performance of the system can reach 1.2–5.5%, depending on the power load. The proposed operation optimization method can be easily extended to similar PEM fuel cell systems for stationary power generators or vehicular applications.