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太阳能、风力、燃料电池发电

质子交换膜燃料电池输出电压稳定控制技术

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Output Voltage Stability Control Technology for Proton Exchange Membrane Fuel Cells

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History

摘要

针对现今质子交换膜燃料电池PEMFC（proton exchange membrane fuel cell）输出电压不稳定、发电效率低下等问题，提出一种对质子交换膜燃料电池输出电压稳定性进行控制的方法。通过PEMFC的热力学电动势、欧姆过电压、总极化电压等相关参数对PEMFC动态模型进行控制，采用模糊比例-积分-导数PID（proportional integral derivative）方法设计PEMFC输出电压模糊PID控制系统。根据梯形函数调整期望输出电压，由氢气流速控制燃料电池的输出电压，实现质子交换膜燃料电池输出电压的稳定控制。通过仿真实验验证控制技术的有效性，结果表明所提方法可有效降低PEMFC电压振荡幅度，使PEMFC电压达到稳定状态，处理时间仅为4 s，说明电池电压稳定控制技术具有高效可靠性。

Abstract

Aimed at the problems in a proton exchange membrane fuel cell(PEMFC) such as unstable output voltage and low power generation efficiency, a method is proposed to control its output voltage stability. The dynamic model of PEMFC is controlled by related parameters including its thermodynamic electromotive force, ohmic overvoltage, and total polarization voltage. By means of the fuzzy proportional, integral, derivative(PID) method, a PEMFC output voltage fuzzy PID control system is designed. According to the trapezoidal function, the desired output voltage is adjusted, and the output voltage from the fuel cell is controlled by the hydrogen flow rate, thus achieving the stable control of the PEMFC output voltage. The effectiveness of the control technology is verified by simulation experiments. Results show that the proposed method can effectively reduce the amplitude of PEMFC voltage oscillations and make its voltage reach a stable state with a processing time of only 4 s, indicating that the battery voltage stability control technology is highly efficient and reliable.

关键词

质子交换膜;燃料电池;输出电压;模糊PID;动态模型;稳定控制

Key words

proton exchange membrane;fuel cell;output voltage;fuzzy proportional, integral, derivative(PID);dynamic model;stability control

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