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Monitoring of operational conditions of fuel cells by using machine learning

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Abstract

The reliability of fuel cells during testing is crucial for their develop t o st benches. For the development of fuel cells on test benches, it is essential to maintain their dependability duri esting. I only possible for the alarm module of the control software to identify the most serious failures because of e large operating parameter range of a fuel cell. This study presents a novel approach to monitoring fuel cell stacks duri testing at relies on machine learning to ensure precise outcomes. The use of machine learning to track fuel cell oper g vari les can achieve improvements in performance, economy, and reliability. ML enables intelligent deci making fficient fuel cell operation in varied and dynamic environments through the power of data analytics and tter cognition. Evaluating the performance of fuel cells is the first and most important step in establishing their reliabil durability. This introduces methods that track the fuel cell's performance using digital twins and clusterin app ches to monitor the test bench's operating circumstances. The only way to detect the rate of accelerated de adati in the st scenarios is by using the digital twin LSTM-NN model that is used to evaluate fuel cell performanc Th pos ethods demonstrate their ability to detect discrepancies that the state-of-the-art test bench monitorin stem ov ooked, using real-world test data. An automated monitoring method can be used at a testing facility to accu ck the eration of fuel cells.

Keywords: Testing data, Fue l, P ormance, AIML

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1. Introduction

Hydrogen is a zero-emissions fuel source since its combustion produces only water. Therefore, hydrogen energy is a viable means to either a low-carbon or carbon-neutral economy [1, 2]. In addition, hydrogen is a possible future energy carrier [3,20], with 1 kilogramme of hydrogen-containing 33.33 kWh of usable energy compared to only roughly 12 kWh in petrol and diesel [4,19]. The fuel cell is the most widely utilized technology for transforming the chemical energy of hydrogen into electricity for use in mobile and stationary power generation. However, the main obstacles that prevent the commercialization of this clean energy alternative are the fuel cells' limited durability and reliability [5,12]. Fuel cell status monitoring approaches for realistic durability and reliability evaluation are crucial for overcoming these obstacles. The user may keep tabs on the condition of the fuel cell in real-time with the help of these methods by sensing the parameters that reflect the fuel cell's state at a predetermined rate. Using visualization and data-driven methodologies, the user can obtain pertinent information