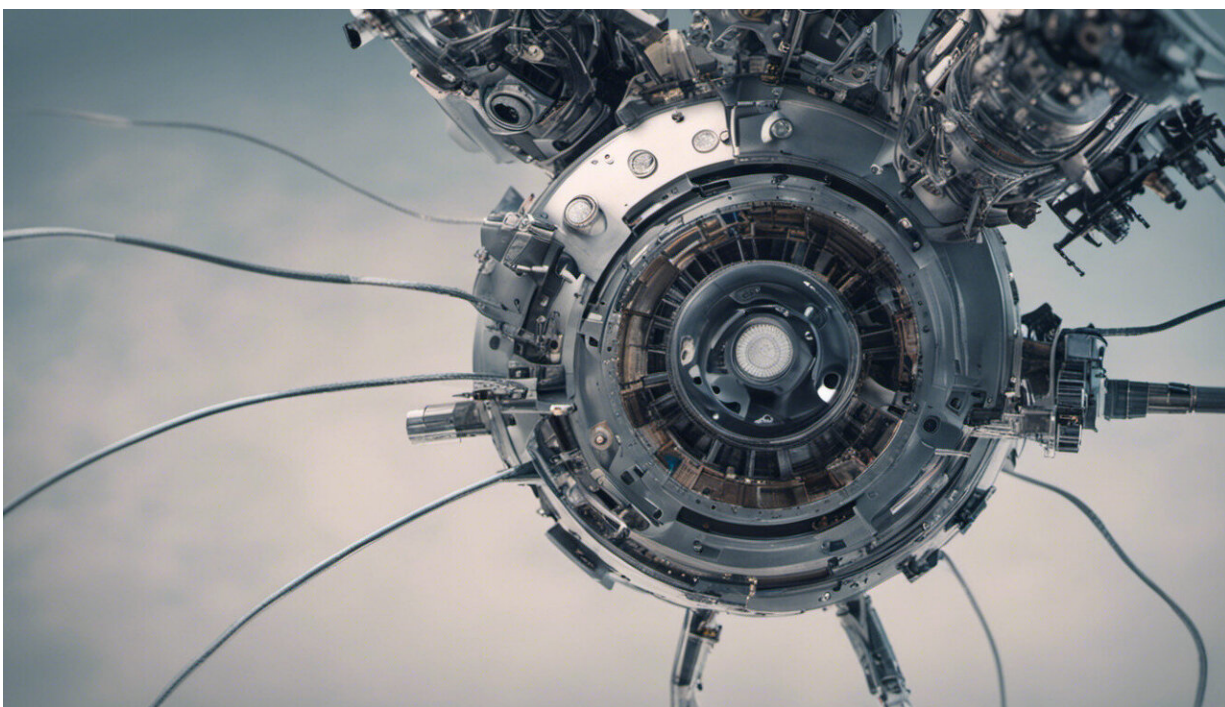


# In situ, onboard evaluation and control of proton exchange membrane fuel cells using magnetic sensors

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Credit: AI-generated image ([disclaimer](#))

Researchers from the University of Tsukuba have developed a method for the real-time visualization of the current distribution inside a fuel cell through non-destructive diagnostics using magnetic sensors.

The researchers have clarified that, in contrast to voltage, the current distribution has a recovery delay. In addition, the researchers have realized a control system that enables the stable operation of fuel cells using only the current distribution as a control index.

Fuel cells are attracting attention as a clean energy source technology because the cells do not produce [carbon dioxide](#) and emit only water during [power generation](#). However, two contradictory phenomena can hamper their performance: flooding, wherein water remains inside the [fuel cell](#) and interferes with power generation, and dry-out, wherein an excess of water is removed and the polymer membrane, through which [hydrogen ions](#) permeate, dries out.

To detect such issues, devices and sensors have been used in analyses based on substantial amounts of data.

A research team has been investigating a method for detecting and controlling fuel cell malfunctions using magnetic sensors. By improving the [diagnostic method](#), the team developed a system to [visualize and control the current distribution in the fuel cell in real time](#). Their work has been published in *Applied Energy*.

The researchers found that control based on voltage indices stabilizes voltage, while the current distribution is biased in the same manner as a malfunction. However, a simple control method based solely on the current distribution kept the current distribution in the fuel cell constant, enabling the fuel cell to operate in a stable state.

In future research, the aim is to establish a comprehensive fuel cell diagnostic and control system with the objective of incorporating this method into real-world fuel cell systems.

**More information:** Yutaro Akimoto et al, In-situ on-board evaluation

and control of proton exchange membrane fuel cells using magnetic sensors, *Applied Energy* (2023). [DOI: 10.1016/j.apenergy.2023.121873](https://doi.org/10.1016/j.apenergy.2023.121873)

Provided by University of Tsukuba

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