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**Simulation and Optimization of Proton Exchange Membrane Fuel Cells**

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**Abstract**

Due to the high efficiency and zero or ultra-low emissions, fuel cell (FC) technology promises to provide alternatives for the internal combustion engine and hybrid power generation. Proton electrolyte membrane fuel cells (PEMFCs) recently attracted attention due to their high power density, low temperature operation, and nearly instantaneous recharging. There are two types of PEMFCs, *i.e.*, H<sub>2</sub> PEMFC and direct methanol fuel cells (DMFCs), both of which utilize PEM to transfer protons. They are the primary focus of this project.

The objective of this project is to construct simulation and optimization tools for FCs that take into account gas, water, thermal, and fuel management, as well as catalytic reaction and mass & momentum transfer.