Stochastic Strategies for Multiple Parameter Identification in Multiphysic Fuel Cell Models

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ABSTRACT

The characterization of Fuel Cells involves a number of physical parameters, upon which models predicting the device behaviour are based. Since the equations are strongly non-linear, these models are extremely sensitive to parameter variations. In situ measurements can provide meaningful operational values, but a very few techniques are available to determine a limited number of parameters.

A solution consists in multiple parameter identification from multiple data, such as polarization curves performed at different temperature, pressure, concentration, and humidification. However the mathematical difficulties increase with the number of parameters, due to the duplicity problem, i.e., several groups of parameters leading to the same performance.

Several numerical tools have been proposed to face these problems. Among the most promising are stochastic algorithms such as the artificial bee colony, the simulated annealing, the particle swarm optimization (PSO), and the differential evolution (DE). Their main drawback of these parameters is the high number of objective function evaluations needed; however, thanks to a particular formulation of the PEMFC model, such drawback can be of minor impact.

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