Numerical Analysis of Gas Manifolds of a PEM Fuel Cell Stack using a Geometrical Simplification Method

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A gas manifold has an important bearing on the performance of a PEM fuel cell stack. But it is not easy to figure out a quantitative influence of a gas manifold on a fuel cell stack performance by experimental tests. In this study, a numerical analysis of a fuel cell gas manifold has been carried out to investigate fluid dynamical behavior of the gas in a fuel cell gas manifold. A commercial computational fluid dynamics (CFD) system has been used for the numerical analysis.
The CFD model to be analyzed consists of inlet and outlet manifolds and gas channels. Because of the complexity of the gas channels and of many number of fuel cells stacked up to 100 cells, the model needs a huge calculation cost. Actually, it is almost impossible to numerically analyze the model as it is. Accordingly, a simplified model of the stack has been suggested in this study. To simplify the model, complex gas channels are simplified to straight porous channels while maintaining fluid dynamical analogous to the original model. Using the simplified model, fluid dynamical behavior of the gases in the manifolds has been simulated with a lower calculation cost.