Modified 3-segment PEMFC dynamic stack modeling for water management

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A zero-dimensional, dynamic model has been developed to simulate polymer electrolyte membrane (PEM) fuel cells. The model based on lumped dynamic model but has been modified to give a more accurate account of the correlation between a performance and a water management. For analysis of this correlation, modified model includes three segments for entrance region, central region and exit region. Because of counter-current flow in the anode side and cathode side, the number of segment is three. The transfer amount of liquid water through the membrane and the current change in the each segment are calculated. This correlation is very important to Vehicle Company prepared to fuel cell vehicle. Because the effect of the humidity of inlet gas flow is quantitatively analyzed to increasing of a volumetric efficiency and a water management of the fuel cell system by a modified dynamic PEMFC stack model. The proposed dynamic model is implemented in MATLAB/Simulink environment. The simulation results are analyzed and compared to benchmark results such as lumped stack results and reference literatures.