**164a A Deterministic Model for PEM Fuel Cells: Analysis of Water Management**

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A comprehensive two-dimensional computational model of a PEM fuel cell has been developed. The model accounts for major transport processes in a single fuel cell including membrane electrode assembly (MEA) and gas distribution channels. A model of water transport within the membrane is incorporated into this model. The coupled governing equations in this model are solved with a computational fluid dynamics (CFD) solver to yield the water distribution profile in the membrane and other domains. Preliminary results indicate that this mathematical model correctly predicts the effect of water management issues (electrode flooding, membrane dehydration, etc) on cell performance through diffusional and ohmic overpotentials. We are currently employing the model to determine optimal water distribution policies (via an optimization model) for the operation of the fuel cell.

Keywords: PEM fuel cells; water management; CFD; fuel cell modeling