Computational Science & Engineering

CSE Seminar at McGill

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Reduced Dimensional Computational Models of Polymer Electrolyte Membrane Fuel Cell Stacks

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Abstract

A model of steady state operation of Polymer Electrolyte Membrane Fuel Cell (PEMFC) stacks with straight gas channels is presented. This is the result of several years of activity of a MITACS project in collaboration with Ballard Power Systems. Some introductory material on fuel cells and the hydrogen economy will be given. The model is based on a decoupling of transport in the down-channel direction from transport in the cross-channel plane. Further, cross-channel transport is approximated heuristically using one-dimensional processes. Mathematically, the model is a nonstandard system of non-smooth boundary value Differential Algebraic Equations (DAEs) with strong, nonlocal coupling. Some preliminary analysis of the system and iterative strategy is given, using simple, constant coefficient, linear versions of the key components of the model. Representative computational results and validation against existing experimental data is shown.