1097-65-206 **Xuan Huang**, **Samuel Khuvis**, **Zana Coulibaly** and **Matthias K. Gobbert*** (gobbert@umbc.edu), Department of Mathematics and Statistics, University of Maryland, Baltimore County, 1000 Hilltop Circle, Baltimore, MD 21250, and **Bradford E. Peercy**.
Numerical Methods for Long-Time Simulations of Partial Differential Equations on Modern Parallel Computing Platforms.

Systems of advection-diffusion-reaction equations occur in a wide variety of applications. Choices for spatial discretizations include finite difference, finite element, and finite volume methods. Sophisticated implicit time-stepping methods such as numerical differentiation formulas handle the stiffness of the ODE systems well and enable simulations to large final times, comparable to the laboratory time scales of the processes being modeled. Krylov subspace methods allow a memory-efficient matrix-free implementation of the linear solves and efficient parallel computing on several compute nodes with multi-core CPUs in a distributed-memory cluster. The appearance of GPUs with hundreds or thousands of computational elements and of 60-core Intel Phi processors as accelerators inside each compute node offers the potential to speed up dramatically the linear solves on each node. We will report on first results for prototype problems as well as a model for self-organizing calcium waves in a heart cell. (Received January 22, 2014)