

Efficient Cluster Computing for Reaction-Diffusion Equations on High Resolution Meshes

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Abstract

The solution to many application models should remain non-negative at all times for physical reasons. For a system of time-dependent reaction-diffusion equations as example, whose true solution is guaranteed to be non-negative, we discuss how non-negativity can be compromised in real-life calculations by the spatial discretization, the time discretization, the non-linear solver, and the linear solver. I will present two application problems of this type and discuss their numerical solution. One problem models the flow of calcium ions in a three-dimensional heart cell, and I will show a special-purpose code that exhibits excellent scalability up to at least 32 processors on a distributed-memory cluster with high-performance interconnect.