SIAM CONFERENCE ON COMPUTATIONAL SCIENCE AND ENGINEERING 2015
March 14-18, 2015

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EFFICIENT ABSTRACTIONS FOR EXASCALE SOFTWARE DESIGN

Abstract

Exascale computing will require software abstractions that expose and exploit hierarchical parallelism while maintaining programmability. This is particularly challenging given the complexity of the physics models that we seek to deploy on exascale systems as well as uncertainty in what future computer architectures will be. This talk explores strategies for effectively dealing with both task and data parallelism in complex PDE solvers, with particular emphasis on turbulent combustion simulation. Specifically, directed acrylic graph approaches for exposing task-level parallelism, coupled with a domain-specific language that provides Matlab-like syntax and supports deployment on multicore or GPU systems are discussed. Together, these abstractions increase programmer productivity while enabling more complexity in terms of physics and hardware targets.