

## Documents

Al-Mouhamed, M.A., Khan, A.H., Mohammad, N.

**A review of CUDA optimization techniques and tools for structured grid computing**

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**Abstract**

Recent advances in GPUs opened a new opportunity in harnessing their computing power for general purpose computing. CUDA, an extension to C programming, is developed for programming NVIDIA GPUs. However, efficiently programming GPUs using CUDA is very tedious and error prone even for the expert programmers. Programmer has to optimize the resource occupancy and manage the data transfers between host and GPU, and across the memory system. This paper presents the basic architectural optimizations and explore their implementations in research and industry compilers. The focus of the presented review is on accelerating computational science applications such as the class of structured grid computation (SGC). It also discusses the mismatch between current compiler techniques and the requirements for implementing efficient iterative linear solvers. It explores the approaches used by computational scientists to program SGCs. Finally, a set of tools with the main optimization functionalities for an integrated library are proposed to ease the process of defining complex SGC data structure and optimizing solver code using intelligent high-level interface and domain specific annotations. © 2019, Springer-Verlag GmbH Austria, part of Springer Nature.

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