MULTITHREADING FOR OPTIMIZING PDES ON MULTICORE PLATFORMS

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THESIS

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ABSTRACT

Existing parallel discrete event simulation (PDES) kernels use process-based implementations and rely on MPI communication library for message passing. The drawback of these implementations is their reliance on multiple message copying operations, even when the two communicating processes are running on multiple cores on the same chip. As the multicore processors become prevalent and the number of cores per chip rapidly increases, process-based communication model results in a highly suboptimal simulation performance.

We investigate alternative thread-based communication model between PDES processes to take direct advantage of the shared memory hierarchy available on modern multicore chips. The shared memory approach eliminates multiple message copying and significantly minimizes synchronization delays. We implemented mutithreaded PDES using ROSS simulator and studied its performance on three hardware platforms: a Intel Core i7, a 48-core AMD Opteron Magny-Cours and 64-core TilePro64 platform. Results shows significant performance improvement on all platforms after carefully addressing some performance bottlenecks.

DEDICATION

I would like to dedicate this work to my family, for there wonderful support throughout these years. I would also like to take this opportunity to convey my gratitude towards my advisors Prof. Dmitry and Prof. Nael for there invaluable guidance, encouragement and support for accomplishing this work.

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