

# **A study of large scale gpu accelerated dense symmetric positive definite matrix solver on the multi-gpu heterogenous cluster in XSEDE**

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## **ABSTRACT**

This research stems from the thought that, to accomplish the complicated tasks assigned to the novel hybrid computational environments, we need to optimize our software solutions to hybridize, combining the strengths from various algorithms to a single package. Following on this idea, we design a dense symmetric positive definite matrix solver for hybrid manycore and GPUs systems that can enable applications to fully exploit the power that each of the hybrid components offers.

This parallel Cholesky decomposition solver, based on a hybrid CPU/GPU ScaLAPACK library, is built to factor and solve the dense symmetric positive definite matrix efficiently with size up to the limit of the CPU memory on the cluster. In this poster we will present the introduction of the XSEDE computational platform with the novel hybrid manycore and GPUs architecture, the algorithm

development, the profiling and scaling study of the performance, and an example of the application of this solver on the heat transfer problem. Results of large-scale computation obtained on keeneland at XSEDE are shown and examined. The matrix with size of 200,000 times 200,000 is solved on 48 nodes, and the performance reaches 140 GFLOPS per GPU. Using the same number of nodes, our approach can solve matrix larger than other numerical libraries, which perform computation on GPU.

## **Categories and Subject Descriptors**

- Mathematics of computing ~ Solvers
- Mathematics of computing ~ Mathematical software performance

## **General Terms**

Algorithms, Performance.

## **Keywords**

Cholesky Decomposition, GPU computation, Linear Algebra Library,