

# Seminar Talk

Hao Ji  
PhD Student  
Department of Computer Science  
Old Dominion University

**Friday, September 26, 2014**  
**3:00 p.m. KH 224**

**Title:**

An Implementation of Block Conjugate Gradient Algorithm on CPU-GPU Processors.

**Abstract:**

In this presentation, we investigate the implementation of the Block Conjugate Gradient (BCG) solver on CPU-GPU processors. By analyzing the performance of various matrix operations in BCG, we identify the main performance bottleneck in constructing new search direction matrices. Our solution is to replace the QR decomposition by Eigen-decomposition of a small matrix for reducing the computational cost of generating orthogonal search directions. Moreover, a hybrid (offload) computing scheme is designed to enable the BCG implementation to handle linear systems with large, sparse coefficient matrices that cannot fit in the GPU memory. The hybrid scheme offloads matrix operations to GPU processors while helping mask the CPU-GPU memory transaction overhead. We compare the performance of our BCG implementation with the one on CPU with Intel Xeon Phi coprocessors using the automatic offload mode. With sufficient number of right hand sides, the CPU-GPU implementation of BCG can significantly outperform that of the CPU-Intel Xeon Phi implementation.

**Biography:**

Hao Ji currently is a Ph.D. student in the Department of Computer Science at Old Dominion University, working with Dr. Yaohang Li on the topic of Scientific Computing on Big Data. Prior to this, he studied at the Visualization and Cooperative Computing Lab on Data Visualization. He received the Bachelor's degree in Applied Mathematics and the Master's degree in Computer Science from Hefei University of Technology in 2007 and 2010, respectively. His research interests include High Performance Scientific Computing, Monte Carlo Methods, and Big Data Analysis.