Resolution of a large number of small random symmetric linear systems in single precision arithmetic on GPUs

Lokmane Abbas Turki[1] and Stef Graillat*[2]

[1]Laboratoire de Probabilités et Modèles Aléatoires (LPMA) – Université Pierre et Marie Curie (UPMC) - Paris VI – France

[2]Université Pierre et Marie Curie - LIP6 (UPMC - LIP6) – Université Pierre et Marie Curie [UPMC] - Paris VI – 4 place Jussieu 75252 Paris, France

Abstract

This talk will focus on the resolution of a large number of small symmetric linear systems and its parallel implementation on single precision on GPUs. The computations involved by each linear system are independent from the others and the number of unknowns does not exceed 64. For this purpose, we present the adaptation to our context of largely used methods that include: LDLt, Householder reduction to a tridiagonal matrix, parallel cyclic reduction that is not a power of two and the divide and conquer algorithm for tridiagonal eigenproblems. We not only detail the implementation and optimization of each method but we also compare the sustainability of each solution and its performance which include both parallel complexity and cache memory occupation. In the context of solving a large number of small random linear systems on GPU with no information about their conditioning, we show that the best strategy seems to be the use of Householder tridiagonalization + PCR followed if necessary by a divide & conquer diagonalization.

*Speaker