Matrix Computations & Scientific Computing Seminar

Organizer: James Demmel & Ming Gu

Wednesday, 11:00AM–12:00Noon, 380 Soda

Oct. 23 **Edgar Solomonik**, UC Berkeley

Communication avoiding parallel algorithms for dense matrix factorizations

The cost of dense matrix factorizations is proportional to that of matrix multiplication, but the dependency structure of these algorithms makes complicates parallelization and necessitates more synchronization between processors. This talk will address synchronization and communication costs associated with LU and QR factorizations, though much of the results extend to other types of matrix factorizations. Communication optimal algorithms for LU with pairwise pivoting and QR with Givens rotations were first introduced by Alexander Tiskin for the BSP model. We will present different algorithms, which aim to achieve the same optimal theoretical costs, but are simpler, more practical, and in some cases have better numerical stability. In particular, we give a communication-optimal algorithm for LU which employs tournament pivoting, and reduces bandwidth and latency cost asymptotically over the implementation in ScaLAPACK. Then we introduce a new QR algorithm, which employs the known communication-avoiding TSQR algorithm on panels, but improves on the efficiency of the trailing matrix update via reconstructing and aggregating the Householder vectors.