Scientific Computing and Matrix Computations Seminar

Organizer: J. Demmel and M. Gu

Wednesday, 12:10–1:00 pm, 380 Soda Hall

Sep 17 **Andrew Gearhart**, UC Berkeley

Bounds on the Energy Consumption of Computational Kernels

Motivated by the large and increasingly growing dominant cost (in time and energy) of moving data, algorithmic improvements have been attained by proving lower bounds on the data movement required to solve a computational problem, and then developing communication-optimal algorithms that attain these bounds. This thesis extends previous research on communication bounds by presenting bounds on the energy consumption of a large class of algorithms. These bounds apply to sequential, distributed parallel and heterogeneous machine models and are extensible to larger classes of machines. We argue that the energy consumption of many algorithms is predictable and can be modeled via linear models with a handful of terms. Given energy bounds, we analyze the implications of such results under additional constraints, such as an upper bound on runtime, and also suggest directions for future research that may aid future development of a hardware/software co-tuning process. We believe that combining our bounds with other models of energy consumption may provide a useful method for such co-tuning; i.e. to enable algorithm and hardware architects to develop provably energy-optimal algorithms on customized hardware platforms.