Sept 2, 2015

Sparse Matrix Computations:

- Sparse: $n \times n$ matrix has n^2 entries
  $O(n)$ nonzeros (Chen's def^{n}).
  "approximately"

- Sparse "in spirit": fast matrix-vector products ($O(n)$)

- Sparse matrix computations: based, @ least partially, on matrix-vector products
  ↳ interesting if they involve $O(n)$ flops

- dense matrix computations: factorizations / decompositions (direct methods).

- "typical" sparse $n \times n$ matrix algorithm: based on solving (iteratively, often) related problems using matrix-vector products with $n \times n$ matrices + decompositions related to smaller matrices.

- Problems we are interested in
  - linear systems
  - eigenvalue problems
  - least-squares problems
  - problems w/ constraints

  arising from
  - PDEs
  - constrained optimization
  - applications (eg. social networks)

- Focus: methods + algorithms

- methods: iterative (CG, GMRES, BiCG-Stab, MINRES) : Krylov Subspace Methods, direct methods
  (systems)

  eigenvalue: power method, simultaneous iterations, Arnoldi / Lanczos, Jacobi-Davidson
  least-squares: LSQR, LSMR CGLS
  constraints: null space, range space

course web-page: www.cs.ubc.ca/~greif
↳teaching

Chen away Sept 25+27