

Options for solving $Ax=b$ ($m \times m$)

- If m is small ($<10^4$), use LAPACK (LU, Cholesky, etc.)
- If m is moderate ($<10^7$), A is sparse, and A 's sparsity comes from a mesh (especially 1d or 2d), consider a sparse-direct solver (UMFPACK, etc.)
- Otherwise, if m is large and Ax is fast:
 - if A is Hermitian positive-definite, use conjugate-gradient
 - if A is Hermitian indefinite:
 - if not too badly conditioned, use MINRES
 - otherwise, use SYMMLQ, GMRES, or some other scheme
 - if A is non-Hermitian, try several possibilities:
 - GMRES *if* convergence is achieved in $\lesssim 100$ steps (e.g. you have a good preconditioner), otherwise some flavor of restarted GMRES
 - QMR (with look-ahead Lanczos)
 - BiCGSTAB(ℓ) with $\ell=1,2,4,\dots$ ($\ell>1$ is most reliable)

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