Randomization techniques for solving large scale linear algebra problems

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In this talk we discuss recent progress in using randomization for solving large scale linear algebra problems, in particular linear systems of equations and eigenvalue problems. We present first randomized versions of processes for orthogonalizing a set of vectors, and we focus in particular on randomized Householder QR and discuss its unconditional stability in mixed precision arithmetics. We then present their usage in the Arnoldi iteration and associated Krylov subspace methods for solving large scale linear systems of equations and eigenvalue problems. The new methods retain the numerical stability of classic Krylov methods while reducing communication and being more efficient on modern massively parallel computers.

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