Numerical Linear Algebra in Lattice QCD

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Lattice QCD is an approach in Theoretical Physics to evaluate the strong interaction as described by the theory of Quantum Chromodynamics in the Standard Model through simulation. The main computational task in Lattice QCD is to solve linear systems with the (lattice) Dirac operator. Since QCD is a quantum field theory, averages over many samples from a target distribution are to be considered, and the coefficients of systems heavily depend on the samples. This is why genuine linear algebra techniques are mandatory in these computations.

In this talk we will retrace the history of algorithmic advances obtained through improved linear algebra methods, starting from the use of advanced Krylov subspace methods in the early 90s, continuing with preconditioning approaches and ending with the algebraic adaptive multigrid methods which represent the current state of the art. We will finish with some new research results for eigenvalue computations needed in lattice QCD..

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