

Cyclic Reduction: from Poisson equation to nonlinear matrix equations

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Abstract

The algorithm of Cyclic Reduction (CR), invented by R. Hockney and by Gene Golub in the mid 1960s, when Gene was a PhD student at Urbana, is a powerful and versatile tool for solving different problems.

Initially designed as a direct method for solving certain block tridiagonal block Toeplitz systems encountered in the finite differences discretization of the Poisson equation over a rectangle, CR has been rediscovered in the framework of stochastic processes as a quadratically convergent iterative algorithm for solving certain infinite systems and nonlinear matrix equations.

In this talk we revisit Cyclic Reduction and give an overview of the nice features and of the applications of this magic algorithm by pointing out rich and unexpected theoretical and computational properties.