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ITERATIVE METHODS FOR SPARSE MATRIX PROBLEMS

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Abstract

The first part of this tutorial will be a general overview of the state-of-the-art in general iterative solution methods for large, irregularly structured, sparse, linear systems. The emphasis will be put on preconditioning methods. Among other methods, we will review standard ILU techniques, sparse approximate inverse methods, and a set of algebraic multilevel methods. We will also briefly discuss multigrid techniques.

In a second part we will be considering parallel algorithms, with an emphasis on those methods which are specifically designed for message-passing platforms. The methods considered in this context are essentially adapted from the Domain Decomposition framework. In particular, we will discuss Additive and (multicoloring) Multiplicative Schwarz techniques, Schur complement preconditioners, as well as various overlapping techniques. We will also touch on some related issues such as graph partitioning, and load balancing.

The 3rd part will deal with eigenvalue problems. We will discuss the main methods used for solving large sparse eigenvalue problems emphasizing recent developments. The (sequential) algorithms will be illustrated with MATLAB.