PREFACE

The Fourth International Symposium on Domain Decomposition Methods for Partial Differential Equations took place May 21 through May 25, 1990, in Moscow. The meeting was held in Uzkoje in the southernmost parts of the city at a recently opened conference facility of the USSR Academy of Sciences. This was the largest international gathering of numerical analysts that has been held in the Soviet Union for a number of years. The meeting attracted about forty Soviet participants and an equal number of foreign scientists.

The President of the Academy, Guri I. Marchuk, himself an applied mathematician and numerical analyst, addressed the opening and closing sessions of the conference. The organizers, led by Yuri A. Kuznetsov, spared no effort in providing the participants with all possible comforts. There were about sixty talks and an excellent spirit among the participants. The average age of the foreign guests was low, which perhaps is natural in this quite new field.

The symposium was the fourth in a series of yearly meetings, and this volume is the fourth "year book" on domain decomposition published by SIAM. Two of the meetings have been held in Europe, in Paris (1987) and in Moscow (1990), and two in the United States, in Los Angeles (1988) and in Houston (1989). The next two meetings are planned for Norfolk, Virginia (May 1991) and Como, Italy (June 1992).

The growing interest in domain decomposition methods reflects a need for the development of fast and convenient algorithms for the new powerful parallel computing systems that are now emerging. When these methods are used, much of the computational work directly attributable to subregions, into which a region associated with a continuum mechanics problem has been divided, can be carried out quite independently on separate processors. The interaction between the parts are accounted for by an iterative method. In each step, there is interaction between neighboring subregions and, in addition, a coarse model, with only a few degrees of freedom per subregion, is often used to enhance the convergence.

It has now been demonstrated that very satisfactory performance can be obtained for the best methods of this kind, even for large and difficult problems resembling these encountered in industry. A set of powerful mathematical tools are now available for the analysis of domain decomposition methods. The lessons learned is also increasing our understanding of the classical iterativemethods for partial differential equations and multigrid methods. The class of problems considered is expanding. Thus at the Moscow meeting there were interesting reports on parabolic problems, the merging of different fluid mechanics models, each appropriate for certain subregions and the use of wavelets in numerical work. The study of mixed finite element methods of non-selfadjoint problems is also coming to the forefront.

This volume is organized into seven parts, each reflecting a major theme in the development of the field.