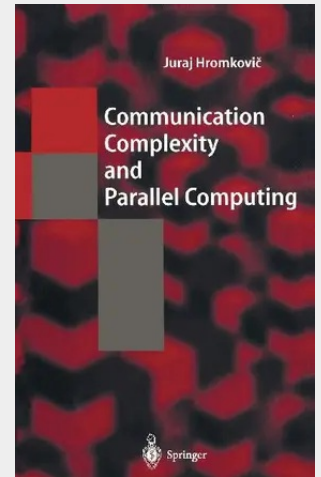


Communication Complexity and Parallel Computing

The communication complexity of two-party protocols is an only 15 years old complexity measure, but it is already considered to be one of the fundamental complexity measures of recent complexity theory. Similarly to Kolmogorov complexity in the theory of sequential computations, communication complexity is used as a method for the study of the complexity of concrete computing problems in parallel information processing. Especially, it is applied to prove lower bounds that say what computer resources (time, hardware, memory size) are necessary to compute the given task. Besides the estimation of the computational difficulty of computing problems the proved lower bounds are useful for proving the optimality of algorithms that are already designed. In some cases the knowledge about the communication complexity of a given problem may be even helpful in searching for efficient algorithms to this problem. The study of communication complexity becomes a well-defined independent area of complexity theory. In addition to a strong relation to several fundamental complexity measures (and so to several fundamental problems of complexity theory) communication complexity has contributed to the study and to the understanding of the nature of determinism, nondeterminism, and randomness in algorithmics. There already exists a non-trivial mathematical machinery to handle the communication complexity of concrete computing problems, which gives a hope that the approach based on communication complexity will be instrumental in the study of several central open problems of recent complexity theory.

This book shows how to establish the communication complexity of distinct computing problems and to apply this knowledge in parallel processing of computing problems. It gives also a survey of this special topic and includes motivation for further research.



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