Combinatorial Algorithms for Communication Networks

The main area of research is focused on the effect of network structure on network communications for parallel and distributed computing (and not only).

Research in this direction includes the design of "good" interconnection network topologies and the investigation of information dissemination on various networks.

The efficiency of communication in networks very much depends on the interconnection structure of a network. Fully (or almost fully) connected networks are reliable and allow short communication paths, but have high costs. However, sparser networks may be more feasible to build while still providing reasonably efficient and reliable communications.

Information dissemination problems in interconnection networks concern transmitting messages from a set of senders to a set of receivers within a network. Specific information dissemination processes are defined by placing constraints on the sets of messages, senders, and receivers, on the network's topology, on the rules that govern message transmissions, and on the amount of information about the network known to individual network members.

One major goal of research in this area is to design network structures which are inexpensive to construct yet allow efficient communication. An example of this work is the ongoing search for minimum broadcast graphs - the graphs with the fewest edges (for a fixed number of vertices) in which each vertex can broadcast in minimum time.

A second major goal is to determine the communication times of existing networks. One direction here is to determine the best communication times of commonly used network topologies under different communication models.

The main algorithmic problem in the area is to find a communication protocol that achieves fastest communication in arbitrary network. This is a hard problem in general.

Several communication primitives, such as broadcasting, multicasting and gossiping will be investigated.

Research in these areas requires knowledge of data communication and network protocols, techniques of graph theory, combinatorics, and design and analysis of algorithms.