Hamiltonian Decompositions of WK-Recursive Networks

by

Jywe-Fei Fang

Department of Computer Science and Information Engineering
St. John's & St. Mary's Institute of Technology,
No. 499, Sec. 4, Tam King Road Tamsui, Taipei, Taiwan R.O.C

Email to: jffang@mail.sjsmit.edu.tw

In massively parallel MIMD systems, the topology plays a crucial role in issues such as communication performance, hardware cost, potentialities for efficient applications and fault tolerance capabilities. A topology named *WK-Recursive network* has been proposed by Vecchia and Sanges under CAPRI(Concurrent Architecture and Programming environment for highly Integrated systems) project supported by the Strategic Program on Parallel Computing of the National Research Council of Italy. The topology has many attractive properties, such as high degree of regularity, symmetry and efficient communication. Particularly, for any specified number of degree, it can be expanded to arbitrary size level without reconfiguring the links. WK-Recursive networks have received considerable attention. Researchers have devoted themselves to various issues of WK-Recursive networks such as broadcasting algorithms, topological properties, substructure allocation and communication analysis.

A graph G is said to be *Hamiltonian-decomposable* if its edge set can be partitioned into edge-disjoint Hamiltonian cycles. Thus, some communication problems, such as many-to-many *broadcasting* and many-to-many *scattering* in all port model, can be nearly optimally solved. In fact, many researchers have studied

this issue of various topologies. To the best of our knowledge, there exists no article addressing this issue of WK-Recursive networks. In this paper, we show that WK-Recursive networks with amplitude $2n+1$ are Hamiltonian-decomposable.

In this paper, we show that there exist n edge-disjoint Hamiltonian cycles in the WK-Recursive networks with amplitude $2n+1$. By the aid of these edge-disjoint Hamiltonian cycles, nearly optimal all-to-all broadcasting communication on all-port WK-Recursive networks can be derived.