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網路可靠度與有效性的研究(2/3)

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Midterm Report for the National Science Council Project
Project Title: Reliability and Efficiency of Networks (1/3)
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Project Duration: August 1, 2004 to July 31, 2005
Project Investigator: Gerard Jennhwa Chang
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This is the second year of the whole project, which is for three years from August 1, 2003 to July 31, 2006. During this year, our results are on diagnosability of multiprocessor systems, group testing in bipartite graphs, and information dissemination. Four papers are finished. The first paper was submitted submitted to a journal, and currently under revision. The others need modifications, and will be submitted to journals shortly. Below are the list and the abstracts of these four papers.

[157] G. Y. Chang, **G. J. Chang** and G. H. Chen, "(t,k)-Diagnosis for matching composition networks," submitted. (NSC93-2213-E002-028))

[147] G. Y. Chang, **G. J. Chang** and G. H. Chen, "Topological properties of sequentially diagnosable systems,"modifying. (NSC93-2213-E002-028)

[129] J. S.-t. Juan and **G. J. Chang**, "Group testing in graphs," modifying. (NSC93-2113-E002-028)

[124] T. B. Chang and **G. J. Chang**, "Optimal algorithms for dissemination of information," modifying. (NSC93-2213-E002-028)

[157] (t,k)-Diagnosis for matching composition networks

$(t,\ k)$-diagnosis, which is a generalization of sequential diagnosis, requires at least k faulty processors identified and replaced in each iteration provided there are at most t faulty processors, where $t \geq k$. This paper proposes a (t,k)-diagnosis algorithm for matching composition networks, which include many well-known interconnection networks such as hypercubes, crossed cubes, twisted cubes and Möbius cubes. It is shown that matching composition networks of n dimensions are $(\Omega(\frac{2^n \log n}{n}), n)$-diagnosable, where $n > 5$.

[147] Topological properties of sequentially diagnosable systems

Since Preparata *et al.* proposed the concept of system-level diagnosis, the problem of sequential diagnosis has remained open. There are excellent papers introduced sequential diagnosis algorithms by restricting the diagnosabilities. Recently, a renewed interest of sequential diagnosis rises because of its correct identification of a large fraction of faulty and fault-free units. In this paper, we propose an idea of solving the problem by the topological properties of sequentially diagnosable systems. Two diagnosis models: the PMC model and the MM* model are considered. We first derive topological properties of sequentially diagnosable systems under the PMC model and MM* model. By these properties, we develop sequential diagnosis algorithms which can achieve the sequential diagnosabilities of the given systems for both models.

[129] Group testing in graphs

This paper studies the group testing problem in graphs as follows. Given a graph $G = (V, E)$, determine the minimum number $t(G)$ such that $t(G)$ tests are sufficient to identify an unknown edge e with each test specifies a subset $X \subseteq V$ and answers whether the unknown edge e is in $G[X]$ or not. Damaschke proved that $\lceil \log_2 e(G) \rceil \leq t(G) \leq \lceil \log_2 e(G) \rceil + 1$ for any graph G, where $e(G)$ is the number of edges of G. While there are infinitely many complete graphs that attain the upper bound, it was conjectured by Chang and Hwang that the lower bound is attained by all bipartite graphs. They verified the conjecture for complete bipartite graphs. Chang and Juan verified the conjecture for bipartite graphs G with $e(G) \leq 2^4$ or $2^{k-1} < e(G) \leq 2^{k-1} + 2^{k-3} + 2^{k-6} + 19 \cdot 2^{\frac{k-7}{2}}$ for $k \geq 5$. This paper proves the conjecture for bipartite graphs G with $e(G) \leq 2^5$ or $2^{k-1} < e(G) \geq 2^{k-1} + 2^{k-3} + 2^{k-4} + 2^{k-5} + 2^{k-6} + 2^{k-7} + 27 \cdot 2^{\frac{k-8}{2}} - 1$ for $k \geq 6$.

[124] Optimal algorithms for dissemination of information

A new communication mode for the dissemination of information among processors of interconnection networks via vertex-disjoint or edge-disjoint paths are introduced and investigated. In this communication mode, in one communication step one or two processors communicating via a path P send their pieces of information to all other processors on this path, too. The complexity of a communication algorithm is measured by the number of communication step (rounds).

In this paper we will design optimal broadcast algorithms for any tree in one-way listen-in vertex-disjoint mode and one-way listen-in edge-disjoint mode and design optimal broadcast, accumulation, and gossip algorithms for k-ary tree and n-dimensional grid in two-way listen-in vertex-disjoint mode.