Self-Validating Diagnosis of Hypercube Systems

Paolo Santi and Piero Maestrini
Department of Computer Science, University of Pisa, Italy
and Istituto di Elaborazione dell'Informazione del CNR, Pisa, Italy
santi@iei.pi.cnr.it, maestrini@iei.pi.cnr.it

Abstract

A novel approach to the diagnosis of hypercubes, called Self-Validating Diagnosis, is introduced. An algorithm based on this approach, called SVD algorithm, is presented and evaluated. Given any fault set and the resulting syndrome, the algorithm returns a diagnosis and a syndrome-dependent bound, T_σ, with the property that diagnosis is correct (although possibly incomplete) if the actual number of faulty units is less than T_σ. The average of T_σ is very large and the diagnosis is almost complete even when the percentage of faulty units in the system approaches 50%. Moreover, the diagnosis correctness can be validated deterministically by individually probing a very small number of units. These results suggest that the SVD algorithm is suitable for applications requiring a large degree of diagnosability, as it is the case of wafer-scale testing of VLSI chips, where the percentage of faulty units may be as large as 50%.

Keywords - System-level diagnosis, self-validating diagnosis, hypercube, multicomputer systems, wafer-scale testing.