# Evaluation of a Diagnosis Algorithm for Regular Structures

REGULAR PAPER

*Antonio Caruso, Stefano Chessa, Piero Maestrini, Senior Member IEEE, and Paolo Santi.*

**Abstract**

*The problem of identifying the faulty units in massive, regularly interconnected structures is addressed. In these structures, the approach aiming at providing correct and complete diagnosis (one-step diagnosis) is not satisfactory, since it is impaired by the limited degree of the nodes in the system graph. This paper analyzes an Efficient Diagnosis Algorithm for Regular Structures (EDARS), which aims at providing a provably correct diagnosis and almost complete on the average. EDARS provides diagnoses which are certainly correct if the cardinality of the actual fault set is below the "syndrome-dependent bound" asserted by the algorithm itself along with the diagnosis. The time complexity of EDARS is O(nt) when executed on regular structures of degree t and size n.*

*The analysis of EDARS relies upon extensive simulation which covered grids of degrees 3, 4, 6 and 8, hypercubes and cube-connected cycles (CCC). The goal of the simulation experiments was to evaluate the significance of the syndrome-dependent bound, asserting diagnosis correctness, and to evaluate the extent to which diagnosis approaches correctness. Simulation was also aimed at identifying those parameters of the interconnection structure that affect the diagnosis completeness. The simulative analysis showed that the degree of the system graph has a strong impact over diagnosis completeness and also affects diagnosis correctness. Furthermore, a comparative analysis of performance of EDARS with hypercubes and CCCs on one side, and grids of same size and degree on the other side, showed that diameter and bisection width influence the diagnosis correctness and completeness. Although it refers to a specific diagnosis algorithm, the analysis reported in this paper appears to indicate that the above mentioned structure parameters may affect the ability of diagnosing faults in regularly interconnected systems.*

***Index terms:*** *Fault tolerance, system-level diagnosis, PMC model, multiprocessor systems, wafer-scale testing.*