Redundancy Optimization of Reliability Models Subject to Imperfect Fault Coverage

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Abstract—In this paper we develop a search procedure for redundancy optimization of reliability models. We consider those systems where the reliability cannot be evaluated exactly but must be estimated through Monte Carlo simulation. At each iteration, two neighboring configurations are compared and the one that appears to be better is passed on to the next iteration. The search procedure uses an increasing sequence of observation at each iteration. The acceptance of a new configuration depends on the iteration number, therefore the search process turns out to be time-inhomogeneous Markov chain. We show that if the increase occurs slower than a certain rate, the search process will converge to the optimal set with probability one. The proposed procedure is illustrated through numerical examples of redundancy optimization for reliability systems subject to imperfect fault coverage.

Keywords—System reliability, Simulation, Stochastic optimization, Markov chains, Imperfect fault coverage

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