A NEW APPROACH TO ELECTRONIC SYSTEMS RELIABILITY ASSESSMENT

by

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ABSTRACT

This research is aimed at improving the reliability of electronic systems, in general, with application to Printed Circuit Boards (PCB) in the electronic packaging and manufacturing industry. We consider the environment to be that of enterprises with complex supply chains, active design chains, and an e-business and e-engineering capability.

The main objective of this research is to design a framework for a hybrid approach combining Case-Based Reasoning (CBR) and Rule-Based System (RBS), in addition to Failure Modes and Effects Analysis (FMEA), Common-Mode Failures (CMF), and Highly Accelerated Life Testing (HALT) approaches, to dynamically identify possible causes of failure before a design is set for production, and to continuously learn from field and test failures and use this knowledge to prevent these failure causes from being incorporated in new designs.

We summarize research done in the area of electronic system reliability and assess the approaches used in the calculation of electronic system failure rates. A detailed literature survey was conducted to investigate the various available reliability prediction models. It includes the classification of the traditional models, discussion of the advantages and disadvantages, and a review and comparison of the key models. We also point out the assumptions used in the calculation of electronic system failure rates and propose a method to estimate the failure rate of a system that does not rely on the assumption of independent failures.

We add a new dimension of reliability to the Virtual Design Environment (VDE), a distributed, heterogeneous information architecture that simultaneously examines thousands of sourcing options for parts, suppliers, and assembly services based on an optimization over cost, and time-to-market. Reliability is added to make a three dimensional criteria set in guiding the design decisions for the design-supplier-manufacturing class of decision problems.

Lastly, the factors influencing Information Technology (IT) adaptation in organizations and changes required in organizational strategy and processes are discussed.