46th ESREDA Seminar

DSM reliability: Do we care about?

Franck BAYLE
Didier REGIS
THALES AVIONICS France

Abstract:

In the last three decades, the integrated circuit industry has followed a steady path of constantly shrinking devices geometries and increased functionality that larger chips provide. These performances and functionality improvements have resulted in a history of new technology generations every two to three years, commonly referred to as .Moore Law (the critical feature size of the elementary devices will drop to 5 nm in 2018, for 14 nm technology node). Each new generation has approximately doubled logic circuit density and increased performance by about 40%.

But the advent of more sophisticated embedded systems that support more powerful functions, and the reliance on DSM (Deep Sub-Micron) process technologies for their fabrication, have brought reliability concerns to the forefront. Because if these technologies offered many advantages in terms of increased performance, reduced energy consumption and cost. Unfortunately these improvements are reached at the cost of a loss of reliability and operational lifetime.

Relevance for the seminar: Until now, wear out failure mechanisms in integrated circuits can be neglected in reliability analysis and constant failure rates are usually used for Safety analysis (FMEA and FTA) and maintenance (DMC and stock exchange). Wear out failure mechanisms are governed by time dependent failure rates which are well modeled by the Weibull distribution.

Novelty: The intensive use of Homogeneous Poisson for reliability analysis leads to easy reliability calculation can lead to erroneous reliability prediction .The originality of this paper is that we will introduce these reliability concerns (like process variation, wear-out effects, and increase sensitivity to atmospheric radiation). If those phenomena are not taken into account at design stage, knowing that the type of maintenance has a main impact on in service component reliability, we will then introduce mathematical concepts like stochastic point process that must be requested in a near future to assess the maintenance cost of an equipment using DSM Technology.

Literature:

[1] J.BERNSTEIN University of Maryland
“Electronic Parts Life extension for military and avionics Qualification »

[2] Ph.PERDU CNES 2010 Asia pacific international symposium Compatibility April 2012
“Lifetime issues, Robustness consequences and reliability challenges for Very Deep Sub micron technologies”