

On-line Testing of Embedded Systems Using Optical Probes: System Modeling and Probing Technology

Chouki Aktouf, Benoît Pannetier, Pierre Lemaître-Auger & Smail Tedjini

LCIS-INPG, 50 Rue B. de Laffemas, 26902, Valence Cedex 09, France

Summary

Many embedded systems operate in very hostile environments. The electronics, i.e. microprocessors, RAMs and other vital electronic devices could suffer from erroneous data, superior output signals caused by the bombardment of particles (e.g. dust). It is crucial to build solutions that allow efficient on-line tests to be applied and test results to be checked.

A practical on-line testing strategy continuously checks the correct functioning of embedded systems in hostile environments. The originality of the work concern test results which are continuously sent to a remote system.

To measure the digital values of the signals determined according to the procedure depicted in Figure 1 by optic means, electro-optic (EO) property of PLT material is employed. In the present case, EO phenomenon can easily be stated as the capacity of a material submitted to an electric field to change its optical refractive index.

As shown in Figure 1, external probes are inserted on different electrical lines of printed circuit board, for instance. The latter is light up by

a laser source. The different probes, according to the voltage of the line, will reflect a low or a high optical intensity. The reflected beams will be deflected and collimated on an optical detector (PIN diodes, CCD arrays or CCD cameras, ...) distant from the system under test. The electrical signals obtained will then be analyzed by a remote system as explained earlier.

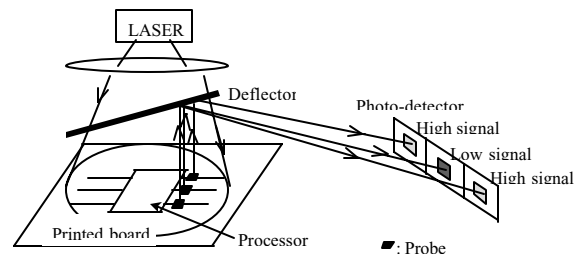


Figure 1: Schematic representation of the proposed probing method

Through the obtained simulation results, it was shown that the speed of the system can be tremendous: electro-optic material is used to create optical modulators that goes up to 40-60. Bandwidth of optical detector can easily be higher than 10 GHz. The proposed system can thus support the speed of today electronics systems.