

Some analysts regard the implementation of the design for manufacture (DFM) approach in the semiconductor industry during the '80s as the key to speed up development cycles for the high-volume production of reliable semiconductor products at low cost. The overall methodology of DFM includes DFR (design for reliability), DFT (design for test), etc. Sometimes the term DFX is used as a summary of different terms. While MEMS university researchers might not have taken DFX approaches into account in their work, the industry is seriously considering DFX methodologies for MEMS.



Patric Salomon

At the request from industry members, Pittsburgh-based MEMS Industry Group (MIG at www.memsindustrygroup.org) focused its 2003 METRIC (MEMS Technology Roadmap and Industry Congress) conference on MEMS reliability with its September 2004 event on MEMS ALT (accelerated lifetime test). Case studies presented by high-volume MEMS manufacturers like Roland Mueller-Fiedler from Bosch and Cleo Cabuz from Honeywell have shown that MEMS are highly reliable products. The difficulty, however, is to prove this to the customer since MEMS ALT methods have not been as developed as in the semiconductor industry. Discussions at METRIC resulted in the request for more research on failure modes, models for lifetime prediction, standardization, instrumentation, and

Lifetime expectations

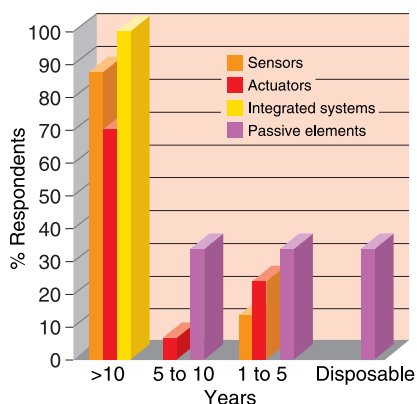


Fig. 1. Expected lifetime for MEMS-based devices with different performance functionalities. *Source for graphics: MEMS Industry Group Survey, Pittsburgh.*

Important reliability needs

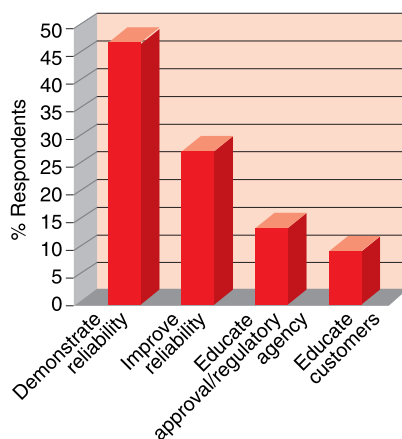


Fig. 2. Reliability-related needs in MEMS industry.

exchange of information to result in a publication of “best practice” examples.

Also, in July 2003, MIG conducted a MEMS reliability survey to ascertain the current status of reliability efforts (Fig. 1, below) and its issues (Fig. 2, above). Over 90% of the respondents said that customers require a demonstration of reliability; but, only 50% showed the reliability of their MEMS device.

In Europe, a consortium of universities, research labs, and companies is addressing the DFM topic in an EC (European Commission) funded project called Design for Micro and Nano Manufacture (PATENT-DFMM). This network of excellence (www.patent-dfmm.org) will be funded by the EC's Information Society Technologies program for four years. The project focuses on problems affecting the manufacturability and reliability of products based on micro- and nanotechnologies be addressed before prototyping and production. This includes DFT, DFR, package engineering, and design and modeling. An industrial advisory board led by STMicroelectronics is overseeing the project's work plan to ensure applicability in industry.

The first MEMS companies “praying the benefits of DFM” were the design software suppliers like Coventor, IntelliSense, and MEMSCAP (now softMEMS) that had built analysis and optimization enhancements into their tools at an early stage. Case studies show that these tools can improve the back-end process.

Is there a difference in the US and the European approaches? On both sides of the ocean, MEMS DFM activities have been ini-

tiated by industry groups—MEMS Industry Group in the US and NEXUS through its design modeling simulation in Europe. In the US, funding has been available to collect information and keep the discussion process going while the EC has decided to support a four-year project with \$7.5 million to approach the major engineering problems. In the long term, PATENT-DFMM is to provide direct services to the industry with an emphasis on small- and medium-sized companies in the form of a one-stop shop. While METRIC is the US forum for discussing DFM methodologies, the Europeans have DFM summer school (first one took place in Scotland, September 2004) and a set of NEXUS meetings. Also, cooperation has been launched via a European delegation to the METRIC conference and US participation in the NEXUS meetings.

Patric Salomon (Patric.Salomon@4m2c.com) is the director/owner of Berlin-based 4M2C PATRIC SALOMON GmbH, a micro/nano technology (MNT) service company that covers marketing and strategy support for the MNT-dependent industry. Salomon has launched a new publication series called enablingMNT Industry Reviews at www.enablingMNT.com.

STAFF

T.B. Zaban, Managing Editor
 Patric Salomon, Guest Writer
 Tim Studd, Editor-in-Chief, R&D Magazine
 Hal Avery, Publisher
 Jean Nickle, Art Director
 Danielle Sidawi, Senior Editor
 Claire Mandala, Customer Service,
 CMandala@reedbusiness.com

BOARD OF ADVISERS

Peter Bley, Forschungszentrum Karlsruhe
 Job Elders, C2V
 Roger Grace, Roger Grace Associates
 Karen Markus, Cronos Integrated Systems
 Paul J. McWhorter, MEMX
 Richard Payne, Polychromix
 Kurt Petersen, SiTime
 Robert Suloff, Analog Devices Inc.
 James R. Von Ehr II, Zyvex
 Steven T. Walsh, University of New Mexico

EDITORIAL OFFICE

2000 Clearwater Dr., Oak Brook, IL 60523
 630-288-8700; fax: 630-288-8710
 e-mail: tstudd@reedbusiness.com

SALES

Pam Nila, Midwest/Southwest
 630-288-8709, Pam.Nila@reedbusiness.com
 Tom Madorna, East Coast
 610-626-0385, tmadorna@reedbusiness.com
 Sharon Malakoff, West Coast
 415-831-3212,
Sharon.Malakoff@reedbusiness.com
 Jack Apostolik, Inside Sales
 973-290-7185, japostolik@reedbusiness.com