Design for Micro & Nano Manufacture (DfMM) News

NoE PATENT-DfMM Status Update

The 3rd quarter of activities within PATENT-DfMM has been dedicated to the launch of activities that aim to put in place the foundations for Virtual Laboratories in Test Engineering, Reliability Engineering, Packaging and Modelling & Simulation.

In the area of **Test Engineering WP1)**, the process has been initiated through the launch of an embedded project to compile an inter-active database of design for testability solutions for new designs that embed MNT. The database targets designers who recognise that embedded test solutions are crucial to meet cost and quality targets in manufacture and require an efficient information source to enable them to identify what techniques are available for specific types of MEMS and MNT based systems.

The **Modelling and Simulation Cluster (WP2)** has initiated discussions with the EDA community and is close to reaching an agreement with MEMSCAP and Dolphin Integration on tool availability. A number of research actions have been approved, e.g. thermal modelling for microfluidic coolers, modelling of flow-paths in microcirculation vessels for Bio-MEMS applications, review of optical simulation and modelling strategies for MOEMS, simulation of stiction in metal to metal resistive contacts, fault modelling and simulation of Flow-FET based systems. An RF project investigating stiction will be carried out in close collaboration with the NoE AMICOM.

The **Reliability Engineering Virtual Laboratory (WP3)** set-up was initiated by an identification of partner capabilities, know-how and services. Initial work targets the creation of several databases, specifically compilation of material properties, fault and degradation mechanisms and instrumentation availability across the cluster.

The **Package Engineering (WP4)** activity is taking a similar approach in first compiling know-how and capability database and compiling state of the art in the field.

The upcoming months will see the development of integration plans and the

Training (WP5) portfolio. It is our intention to engage with a number of community events that are taking an interest in design for manufacture technology for MNT, including the IEEE conferences on Design Integration and Packaging (DTIP) and the European Test Symposium (ETS). Involvement with NEXUS is planned to increase through the active participation in the Methodology Working Group (MWG) Reliability that will complement

PATENT-DfMM Networking (WP6) through the MWG Design, Modelling and Simulation (DMS). Tighter collaboration with the MEMS Industry Group (MIG) in the USA is also planned. In this context PATENT-DfMM will participate actively in the next meeting in Pittsburgh to strengthen links and develop plans for further collaboration.

The creation of a **Service Organisation (WP7)** over the coming 4 years will be supported by the Industrial Advisory Board (IAB) that has already provided valuable guidance to the management team in the context of long-term objectives. Technical work in the context of cross-work package activities towards a DfMM methodology has been initiated. This project will focus on the development of a methodology to assess the effect of packaging on the performance and reliability of microsystem devices. Collaboration across all of the PATENT-DfMM technical work packages will provide the required test, modelling and simulation, reliability and packaging skills.

SME support has been provided through the approval of a project to develop a thermal test methodology and associated equipment.

DfMM Summer School to run 15-17 Sep 2004, ISLI, Livingston, Scotland

Day 1: MEMS tutorial, covering MEMS fundamentals, Design for Testability, Packaging, Reliability and Modelling.

Day 2: Presentations related to research in "Design for Micro & Nano Manufacture".

Day 3: Vendor tools and hands-on training on EDA tools.

PATENT-DfMM Reliability (WP 3) Workshop, 7-8 Oct 2004

The First Workshop organized by the Reliability Cluster of PATENT-DfMM will be held in Sinaia, Romania, jointly with CAS (4-6 Oct 2004), organised by IMT-Bucharest. **www.imt.ro/Cas/Default.htm**

DfMM R&D Projects launched

Being an FP6 Network of Excellence, PATENT-DfMM has a very flexible approach to distribute budgets within the project. In an annual (internal) review, which is supported by the Industry Advisory Board (IAB), priorities for the next period will be set. Internal calls for project proposals will then be launched throughout the year.

The following internal projects have been launched recently as part of the PATENT-DfMM research and integration activities:

- Design for Test (DfT) for Biosensor and for Biosensor Interface
- System Simulation of Micro-Electronic Fluidic Arrays
- Quality Factor measurement and reliability for MEMS resonators
- MEMS Testing through Bias Superposition
- Benchmarks for MEMS testing
- Modelling and testing of microengineered cooler for microelectronics packaging
- Mechanisms of formation of preferential flow paths in microcirculation vessels for BIOMEMS
- Review of optical simulation and modelling techniques for MOEMS
- Simulation of the stiction effect in the metal-to-metal resistive contact occurring in MEMS switches
- Fault Modelling and System Simulation of Flow-FETs
- Methodology to assess the impact of packaging on MEMS components
- Reliability of M(O)EMS in harsh conditions
- Reliability of MEMS basic movable structures
- Methodology and high level design of failure modes of MEMS
- Input for materials data bases
- Failure mode database
- MEMS testing by electro-thermal excitation
- Scoping study for future programme to "Demonstrate a methodology for reliable, packaged Micro&Nanosystems"

More information will be available from the PATENT-DfMM website: **http://www.patent-dfmm.org/**.

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MACROS project to provide behavioural models including non-linear effects

University of Lancaster - partner in PATENT-DfMM - is involved with Dolphin Integration and ST Milan in a European project called MACROS. In this project, behavioural models including non-linear effects are developed, validated against measurements and integrated into a library. All the models of the library will be available with an EDA environment extended to support advanced VHDL-AMS language features. The designer will not only be able to model and simulate the ideal (fault-free) MEMS behaviour, but also the influence of package induced effects, pre-stress, mode coupling and failure modes of MEMS structures within the complete MEMS in Dolphin's Mixed Signal, Multi Level and Multi Domain simulator SMASH.

For more information about MACROS project, please visit:
http://www.dolphin.fr/projects/macros/index.php

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First DfMM Summer School attracts industry participants

The first training event for the PATENT-DfMM network of excellence was held at ISLI, Livingston, Scotland, 13-15 September. Over the 3-day programme, 30 delegates from around Europe were presented with a variety of interesting MEMS-related tutorials and presentations from research partners involved in the network. The themes covered MEMS fundamentals, failure modes, modelling and test techniques, through to packaging effects, and included an opportunity to try various CAD tools and talk to some of the experts in the DfMM field. In addition to academics and research students, the audience included industrial delegates; many of these expressed interest in the topics, which are being developed into longer training courses.

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