IeMRC Research Portfolio Themes

Design for X

Research Issues:

- Test strategies
- Collaborative design
- Partitioning
- Multiphysics tools
- High frequency
- DFAssembly
- DfDisassembly
- Power management
- DfRecycling
- Thermal management
- Reliability
- DfManufacture
- Low volume DfManufacture
- Tests for reliability

Vision: to provide underpinning research into design methodologies that will enable the UK electronics industry to retain and enhance its competitive edge in high added value and low-volume sectors. Objectives for this theme are to deliver research into design methods that support existing strengths and underpin the development of future markets for UK electronics and to support other IeMRC themes in developing solutions in challenging environments.

The complexity of next generation systems, coupled with their sensitivity to conflicting factors is creating demands on design and manufacturing. Solving these conflicts requires a transition from performance-driven design, to design where manufacturability, sustainability and manufacturing effectiveness (e.g. agility) are driving forces of an integrated process. At present, much of the design within an organisation and through its supply chain is disjointed. At each stage in the process from chip through to PCB then system, designers optimise their own segment, oblivious to the impacts on other stages. Solutions involve combinations of mathematical modelling, rules for resolving conflicts, structured partitioning and hierarchical decomposition, which must link to many design tools to provide the supportive environment needed to produce complex designs.

Projects supported under the DfX theme have dealt with a number of emerging topics in electronics manufacturing including: design methodologies for system in package (SiP); design methods for complex, low volume electronics; Physics of Failure (PoF) models for power electronic modules; prognostics and health management and through life cost estimating within defence systems.

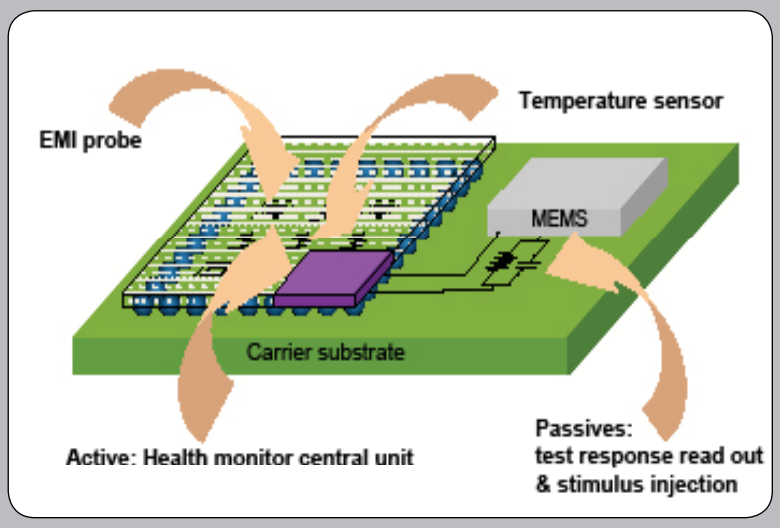
Highlights include:

1. Multi-physics models that integrate prediction of electric fields, temperature, cure kinetics, and stress have been developed to aid in the development of a novel micro-engineered microwave oven in the FAMOBS project. The results have formed the basis for an EC funded FP7 project.

2. A novel methodology for design for manufacture for SiP has had an impact on industrial partners NXP Semiconductors (optimising solder joint design) and SELEX (qualifying products for application).

3. PoF based lifetime models for SnAg solder joints have been developed in the Power Electronics Flagship. Comparisons between predicted failures and experimental results showed good agreement. The PoF work fed into the TSB-funded MPM project to develop a PoF-based design tool for power electronic modules.

4. A model for the evolution of the microstructure in SnAgCu solders has been developed and differences observed experimentally in the size and morphology of intermetallic compounds can now be explained.



Embedded MNT sensors concept

This project is investigating system in package concepts to incorporate MNT-style sensors that may be used in concert to monitor the health of a package or system. Thin film resistance temperature, capacitive humidity, piezoelectric stress / pressure and electromagnetic radiation sensors are being combined.