Advanced Applications & Design of Microsystems

Introduction
Micro Technology is gaining public attention as a new key technology to generate growth & contribute to world prosperity. Related industries span from medical & biomedical to optics, communications, aerospace, automotive & environment

Course Overview
This new module on Design on Advanced Applications & Design of Microsystems is the advanced training programme for this technological area focussing on 2 areas:

- Design & commercialisation of Microsystems
- Advanced applications of Microsystems

Course Objectives
This course will provide you with an overview of the state of the art technology, design methods & applications of Microsystems in addition of the market requirements for a successful commercialisation

Audience
Managers, postgraduate, Microsystems engineers & scientists who are passionate about investigating the current market or wishing to expand upon their expertise, will benefit from such programme

Course Content

1. **Microsystems/MEMs/MST markets & infrastructure**:

- Micro nano technologies
- Markets & killer applications
- Commercial success with MNT: infrastructure and services,
- Europractice service offer
- MST and MNT in the European Commission Framework (FP6)
- Worldwide networks & roadmaps
- New EC FP6 Network of Excellence „Design for Micro Nano Manufacture

Patric Salomon, 4M2C Patric Salomon GmbH, Germany: Director of a micro nano technology service company that focuses on all aspects of marketing & strategy support for the macro & nano micro technology industry

2. **Commercialisation of Microsystems**:

- Focus on industry structure: key drivers & key players
- State of play: entrances, 2 examples of companies' activities, closures, exits

Dr Paul Atherton, Nano Ventures, UK: active angel investor particularly interested in commercialising technology who has invested in more than 10 start-up companies in the last 3 years

3. **Microsystems design**

- What is a microsystem?
- How to integrate sensors, actuators and microstructures with micro-electronics to produce a microsystem?
- The design expertise required to produce a complete microsystem
- Which partners do you need to get a commercial microsystem to market?
- How to ensure the customer's requirements are met?

Dr Diana Hodgins, ETB, UK: Managing Director of a leading company in design of sensors & Microsystems, awarded the Women Inventor of the Year Award for Industry in 2002

4. RF MEMs

- Application area
- Microwaves and the electromagnetic spectrum
- Characteristic features of microwaves
- Components at microwave frequencies
- MEMS passive microwave components
- RF MEMS switches and varactors
- RF MEMS acoustic devices

Dr Paul Kirby, Cranfield University, UK: senior lecturer who developed the world's first high performance thin film piezoelectric accelerometer

5. Micro gas sensors: an introduction

- Why sense gases?
- Which gases?
- How to sense?
- Why move to microscale?
- Types of sensor?

Dr Rob Dorey, Cranfield University, UK: lecturer in functional ceramics
micro processing within a nanotechnology group, who was awarded a Royal Academy of Engineering EPSRC post doctoral research fellowship

6. Foundations of microfluidics

- Definitions
- Markets
- Basic microfluidic principles and devices arising
- Materials for microfluidics
- Fabrication technologies for microfluidics
- More microfluidic devices
- References and websites

Prof David Allen, Cranfield University, UK: Professor of Micro Engineering in the Advanced Materials department & consultant in more than 50 companies worldwide in photochemical machining

7. Cantilever sensors

- Cantilevers
- Sensing motion
- Delivery systems
- Functionalisation
- Sensing
- DNA

Dr Steve Dunn, Cranfield University, UK: lecturer in nanotechnology regarded as a national expert in piezoelectric atomic force microscopy

8. Bioanalytical applications:

- Microfluidics systems for cell analysis: sampling/delivery, cell sorting, cell lysis, cell analysis, cell fusion, cell arrays

- Microfluidics sytems for DNA & protein analysis: early hand-held devices, DNA extraction, PCR, CE on chip, pyrosequencing on chip, protein purification, protein analysis

- Surface base systems for DNA & protein analysis: DNA microarrays (technology&applications), protein microarrays
- Microfluidics for tissue engineering: transplantations, mechanical devices, definition tissue Engineering, cells, biomaterials, microfluidics, commercial examples

Dr Helene Andersson, Silex, Sweden: Business Manager for life science, who was selected in 2003 as member of "TR100: Innovators under 35 who will create the future"

9. Advanced Applications of Microsystems: Gyroscopes and Accelerometers

- Introduction to advanced inertial sensors
- Gyroscopes - principle of operation
- Example applications of accelerometers and gyroscopes
- Model based performance enhancement
- Testing of high performance inertial sensors (Virtual Institute Laboratory)

Dr Swavik A. Spiewak, University of Calgary, Calgary, Canada: Associate Professor in the Engineering Department, currently involved in developing an Internet controlled MEMs laboratory

10. Free space optical Microsystems

- Basic optics – limitations and possibilities
- Micro-fabrication technologies
- Spectrometers
- Wavefront sensors
- Fiber switches
- DLP from Texas Instruments
- Adaptive optics
- Market trends
- Conclusions

Prof Gleb Vdovin, Delft University of Technology, The Netherlands: Associate Professor at the Faculty of Information & Systems Technology. Current research includes micro machined adaptive optics.