MEMS design

Instructor:

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Description:

Based on the experience of the Europractice support team and the successful Stimesi training courses, this tutorial will give a condensed overview of many aspects and tools that are involved when entering the MEMS design. Without focusing to a certain design or simulation tool, it delivers generic know how about the different design phases, methodologies and pitfalls. It invites designers and engineers from different disciplines, with a slight bias towards IC designers who are nowadays confronted with more than Moore design cycles, to take a bird eyes view and better grasp the MEMS design culture and identify their contribution. Also product managers and planners are addressed.

The tutorial is highly visual and dynamic illustrating the underlying message to a non-expert audience. Yet, even experts can learn from it by the systematic and generic overview.

Real fabricated microsystems and personal experience cases further illustrate methodologies, capabilities and pitfalls. They are interleaved with the presentations to illustrate the course material

Starting with a systematic approach to design space exploration and FMEA, the tutorial focuses on MEMS design tools, methodologies, design flow, setup, FEM/FEA, co-simulation. An overview will be given of design tools: layout, process tools, simulators, ... in the context of different design tasks and design cultures.

MEMS design can generally be divided into two tasks: the 'creative' aspects and the 'verification' part. The creative part couples with the verification part by a tedious and labor intensive modeling part too often limited to only layout or (3D) drawing actions, limiting free time for the creative and verification cycle. Different approaches to automation are addressed during the tutorial.

In the 'creation-verification cycle', *functional* verification is mainly done by simulations. Finite Element Modeling (FEM) and Analysis (FEA) is still the workhorse for multiphysics simulation and verification. Other techniques like Reduced Order Modeling (ROM) and Behavioral Models (BM) and their usefulness are explained in the context of co-simulation of MEMS+IC.

Finally, *layout* verification closes the tutorial. Attention is pointed to the importance of a well documented design rule manual, usually underestimated. As it reflects in reliable Design Rule Checking (DRC) and Tape Out procedure, it has a large effect on the chances of a functional device.

Objectives

- Create a general overview of many aspects that are involved when entering the MEMS (design) discipline.
- Explain what is involved when designing from the idea to production. Provide an overview of tools, tasks and flow.
- Classify MEMS simulation approaches.
- Explain design rules to enable attendees to design with confidence.
- Give participants a taste of typical design tools.
- Support participants to start or improve design strategy.

Biography:

Jan Bienstman has been active as MEMS designer since 1990. He received a M.Sc. degree in Electrical- Mechanical Engineering from the K.U.Leuven in 1990. In 1991, he followed an Erasmus postgraduate program on biomedical engineering at the University of Patras, Greece and the K.U.Leuven. He joined the research group ESAT-MICAS of the K.U.Leuven in 1995, where he received a Ph.D. in the field of MEMS micro resonators and nonlinear behavior of sensors. From September 2000 he was a senior MEMS designer at Melexis (Tessenderlo n.v. Belgium) in the automotive field of safety systems. In 2005 he joined Vivactis, an imec spin-off focusing on nano-calorimetry. He temporary held a position as lecturer at the Engineering School Group-T Leuven and joined in October 2007 the INVOMEC division of IMEC where he's responsible for the MEMS and Silicon Photonics MPW service of EUROPRACTICE.

References:

[1] http://www.stimesi.org

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[3] http://www.euro-dots.org