

Organization(s): Air Force Research Laboratory

Title: Composite CAD Tool Baseline

Duration of Effort: January 1997 - October 2000

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MTO

Composite
CAD

Objectives:

The goals of this project were to baseline the Composite CAD tools and demonstrate a system-on-a-chip design methodology. The design of a MEMS Integrated Technology Information Node, referred to as MEMS-PUSH, was used as the test vehicle for the CAD tool evaluation. The MEMS-PUSH integrated sensing (vibration & shock), timing (MEMS oscillators), analog conditioning and digital control.

Major Accomplishments:

- Tools installed and evaluated from: Analog Devices, Analog, Berkeley, CFDRC, CMU, Coyote, Microcosm, MIT & Tanner.
- Virtual prototype and mixed technology model of the MEMS-PUSH system developed and utilized to implement floating-point package and FFT algorithms.
- Completed design and analysis of nine fabrication runs, (1 MUMPS & 8 MOSIS), containing MEMS test structures, resonate structures, and integrated subsystems.
- Detailed analysis of coupled electrostatic/mechanical analysis tools performed on resonators/oscillator structures representing both comb drive and single beam structures.
- The IFTC MEMS Testbed developed and utilized to calibrate empirical measurements with simulation results. Testbed used to provide data to Composite CAD team members.
- Participated in team development of the VHDL-AMS design packages, modeling guidelines, and a tutorial document to support model interoperability.
- CMU based synthesized MEMS accelerometer design analyzed based on the MOSIS-CMU process. Tool based solid model and 3D analysis performed.
- Accelerometer reduced order models developed for integration with analog closed loop circuits. Three IMU variants designed and evaluated.
- Simulated test case fluid flow models to assess fluidic flow simulation tools.

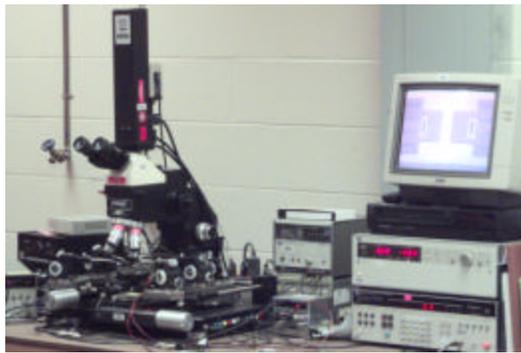
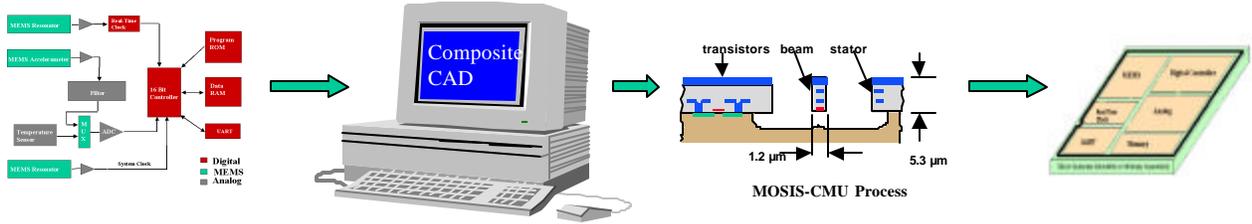
DOD Impact:

- Provided AFRL researchers with the opportunity to understand CAD and microsystem technologies.
- Microsystem experience currently leveraged by MEMS-based PICOSAT Inspector (MEPSI).
- Tools applied to AFRL/IFTC in-house study, *MEMS for Computing*, and follow-on effort, *MEMS Artificial Neural Network*, which now has a patent pending.
- AFRL Information Directorate (IF) microsystem experience is being leveraged as future programs involving biotechnology and nanotechnology are being developed.

Technology Transfer/Products:

- Established CRADA with Interscience, Inc. Troy, NY, to incorporate MEMS test method into their MEMSPEC2000 product.
 - Software for implementing MEMS Test Method on which there is a patent pending was transferred under non-disclosure agreements for evaluation to CRADA partner and the University of Colorado.
 - Transitioned CAD tools to AFRL Sensors Directorate (SN) who has primary responsibility for MEMS device development within AFRL.
 - Served as consultant with AFRL Materials and Manufacturing Directorate (ML) which, in conjunction with Munitions Directorate (MN), explored the impact of different materials in a military operational environment on performance of a MEMS component originally designed for a commercial product using MEMCAD.
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MEMS Testbed