Microelectromechanical Systems (MEMS): Miniaturization Beyond Microelectronics

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Abstract

The concept of a "system-on-a-chip" quickly invokes in our minds integrated microelectronic circuits. It took the semiconductor industry over 30 years to reach this level of integration, putting many millions of transistors on the same chip to perform extremely complex digital functions. Throughout this "system-level" revolution, the core element remained the MOS transistor, and the interface between the electronics and society has changed little.

The same microfabrication methods of the electronics industry are now being adapted to design components and systems that integrate multiple physical functions including mechanics, fluid flow, optics, biology, etc on the same substrate. The net result is systems for complex non-digital applications, and sophisticated interfacing with the "real world." This technology is only beginning to emerge and the level of integration is in its early stages, yet the enabled functionality has already been phenomenal. For example, the integration of a small accelerometer and gyroscope with electronics is now at the center of modern vehicle stability systems. In another example, the DMD? display contains nearly one million little mirrors to control the intensity of individual pixels. In biology and biochemistry, on-going efforts aim at miniaturizing genetic analysis and diagnostic systems.

In this presentation, we will review the basic fundamentals of microelectromechanical systems. The presentation will also include a brief survey of existing microsystems and provide a peek into the future.