Measurement Technology for Industrial Sensors

Polytec's Micro System Analyzer is Essential for Developing Industrial Sensor Systems

The Industrial Sensor Systems (ISS) department at the Institute for Sensor and Actuator Systems at the Technical University of Vienna examines the following topics in the field of sensor technology:

- Physical chemical sensors
- Fluid components and sensors
- Micro and nano-systems for fast chemical and biological analyses (e.g., "Lab on a Chip")
- Sensors for automotive applications
- Magnetic field and radiation sensors
- Sensor system modeling and evaluation

The sensors are designed and manufactured at the institute using selected process technologies chosen specifically for silicon-based sensor production, some of which were developed in-house.

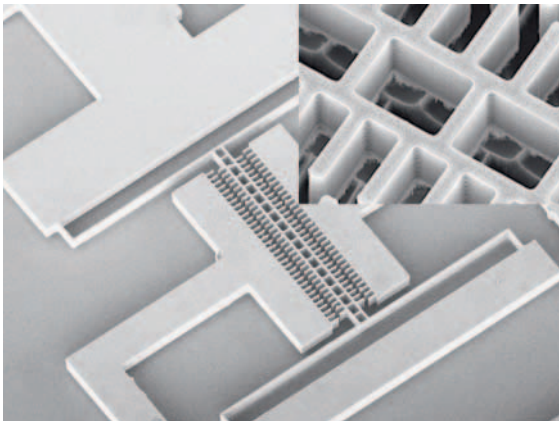
Measuring 3-D Dynamics and Surfaces Using Light

The applied research and development work on industrial sensor systems conducted by Prof. Dr. Keplinger and his staff in the ISS department demand corresponding state-of-the-art measuring equipment. The MSA-400 Micro System Analyzer at the institute and the MSA-500, its current successor, are all-in-one measurement systems for taking dynamic and static measurements on micro electro mechanical systems (MEMS, Fig. 1) and other microstructures. They allow you to analyze and visualize structural vibrations and the surface topography in microstructures and employ a unique combination of non-contact measuring technology procedures. **More Info: www.polytec.com/mems**

Miniature Spies in the Production Process

Professor Keplinger's department is developing innovative sensors that literally ride along with the production process and continuously transmit the chip-level pressure, temperature or other important process parameters during the individual steps in manufacturing to an external receiver. To measure the pressure, a small structure sensitive to changes in process pressure but compatible with the manufacturing steps must be designed, built and tested. Current designs use a statically deflecting structure and not a vibrating system. To provide performance data for refining the design, the Micro System Analyzer was used to measure the sensor deflection and sensitivity – without even touching the unit.

Fig. 1: SEM image of a micro electro mechanical system (MEMS). Image: K.L.Turner/UCSB



"The miniaturized pressure unit is only a few square millimeters in size, making the optical measurement procedure of the MSA the perfect solution for small object characterization. Contact measurement procedures would severely compromise the accuracy of the data when scanning the unit due to the influence of mass loading. To properly design the sensor, we need an uninfluenced measurement – an obvious case for optics-based probing using the MSA-400," emphasized Professor Keplinger.

"Another significant benefit to using the MSA over tactile instruments is made obvious when testing the MEMS devices under operating conditions. Tactile instruments can make measurements without too much effort only under ambient conditions. Our sensor development requires testing in a chamber at vacuum or high pressures. Modifying a tactile instrument to function inside such a chamber is not feasible unless a lot of effort is expended. Instead, our pressure chamber is fitted with optical inspection windows allowing us to make measurements with the MSA without any difficulty at all, regardless of whether the device under test is in vacuum or at a pressure of 5 bar."

Today's Research is Unthinkable Without the MSA

Professor Keplinger (Fig. 3) could not imagine performing his research today without the MSA-400. In the past, we frequently wound up with "measurement gaps" in our work. Some structural responses could only be calculated and not directly measured. Several years ago, research and development was focused on diaphragms, and then came bridges and moving beams. "Making the transition to working with microstructures without the MSA-400 would have been extremely difficult. In fact, it would have been impossible," surmised Professor Keplinger. Not only can the device measure single spot displacements, it can also scan surfaces without making contact and deliver a deflection shape.

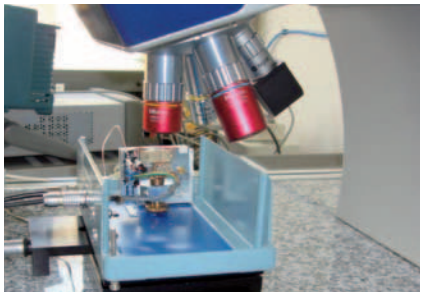


Fig. 2: A newly developed sensor is shown with connected control electronics positioned under the objective lens of the micro system analyzer.

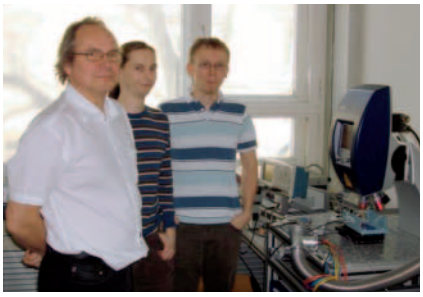


Fig. 3: Prof. Dr. Franz Keplinger (front) and two doctoral students of the ISS standing next to the "indispensable" micro system analyzer.

"We are now able to quantify responses we couldn't measure before – in etched holes for example. Or, perhaps, the significant effect of the surface area on device performance during miniaturization since volume reduction is a cubic function whereas area reduction is only a square function. With today's swift pace of technological innovation, we no longer have the time for trial and error. Measuring equipment like the Micro System Analyzer from Polytec is vital if you want to stay competitive", concludes Professor Franz Keplinger. Vienna is not the only place in Austria where researchers need to work with the MSA-400. Other Austrian universities are also competing for the limited time slots available to use Polytec's micro system analyzer. Although it is a complex system, the measurements performed on the MSA are intuitive and meticulously thought out. The detailed menu navigation and user-friendly program interface allow you to quickly begin taking data and doing complex analysis.

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www.ituw.at

Industrial Quality Inspection of MEMS Pressure Sensors

Pressure sensors in vehicles are used to determine the pressure in water, oil and various compressed air systems. With MEMS pressure sensors, the physical parameters to be measured create a reversible distortion of a specially designed mechanical silicon microstructure. Here, the micro system analyzer is used in the manufacturing process for characterizing specific sensor parameters at the wafer level. This way, defective components are detected and sorted out during the measurements – saving significant time, since other unnecessary processing steps can be avoided in the process. **www.mems-analysis.com**