

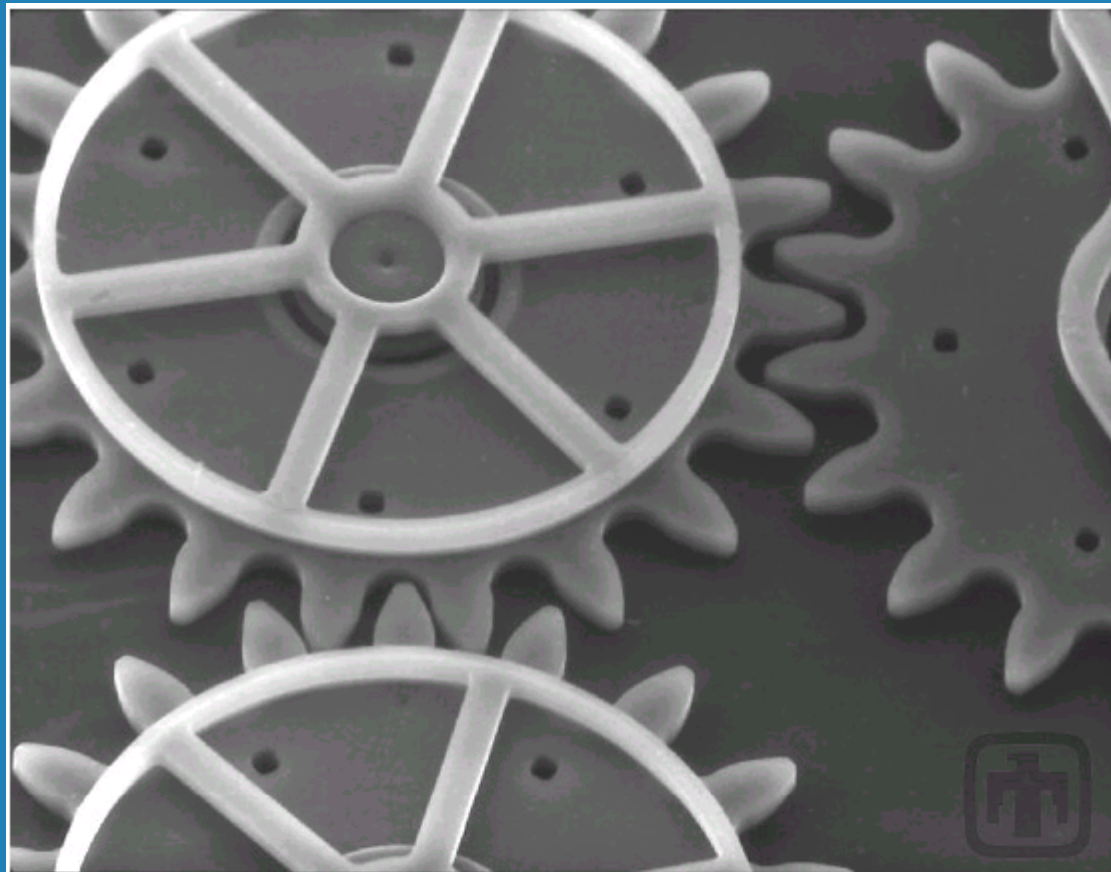


# Photos of MEMS Devices

---

Spring 2010  
ELEC 5820/6820

# MEMS Gear Drive

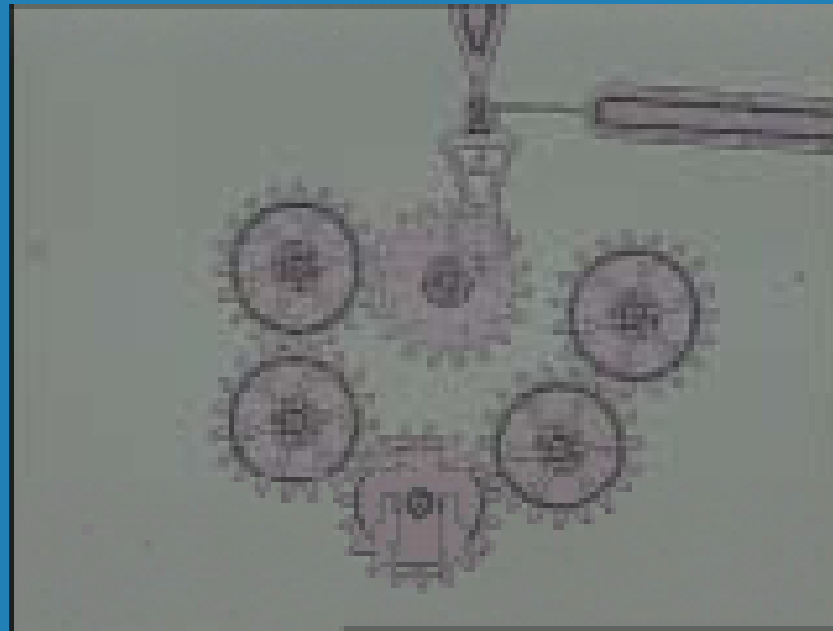


Courtesy: Sandia

# Complex Gear System



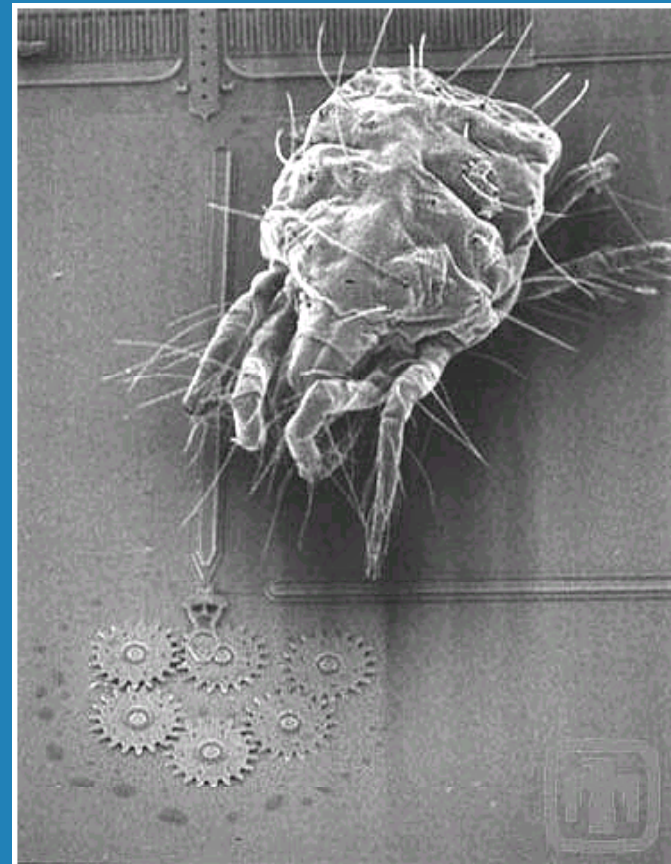
# Sandia MEMS 6-Gear Drive Train



# Importance of Cleanliness During Microfabrication

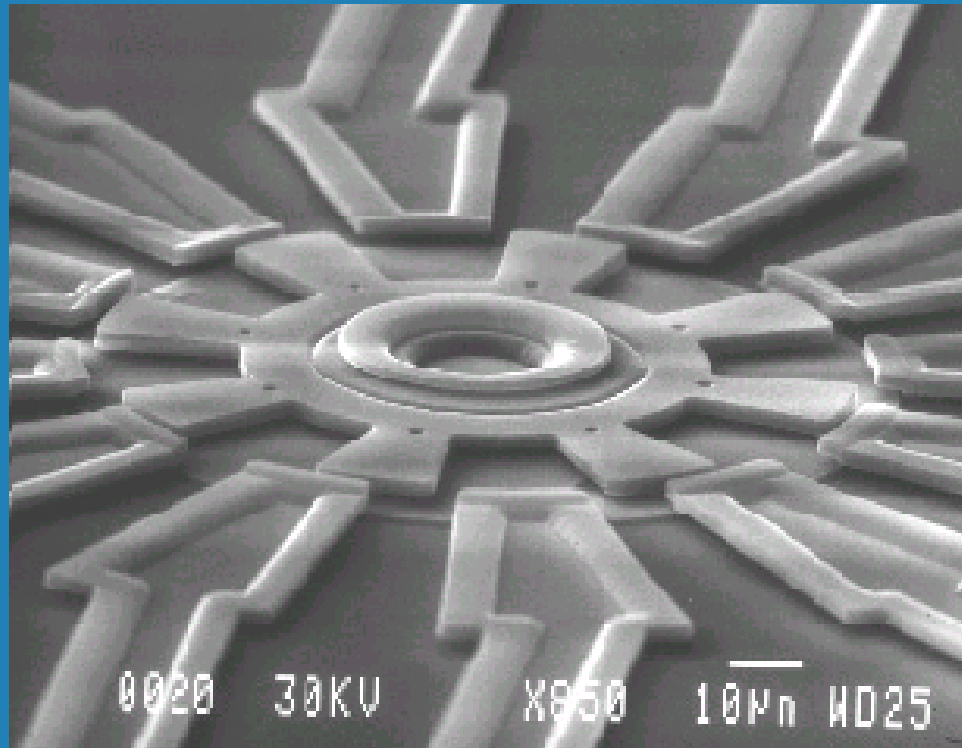
Photo of a dust mite on a MEMS gear drive

Device needs to be debugged!

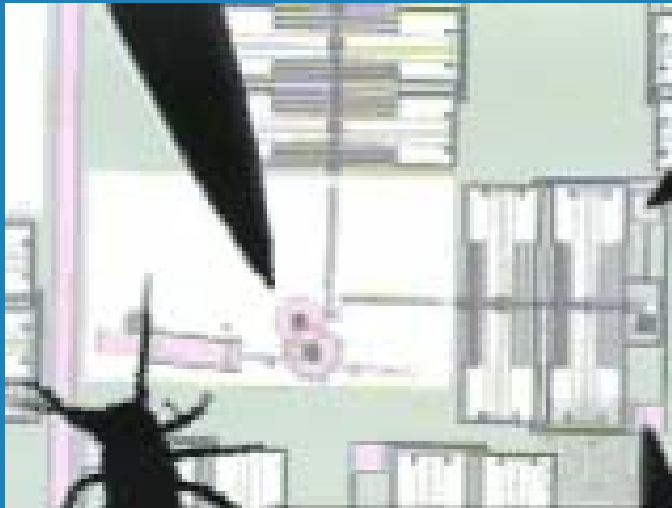


Courtesy: Sandia

# MEMS Rotary Motor

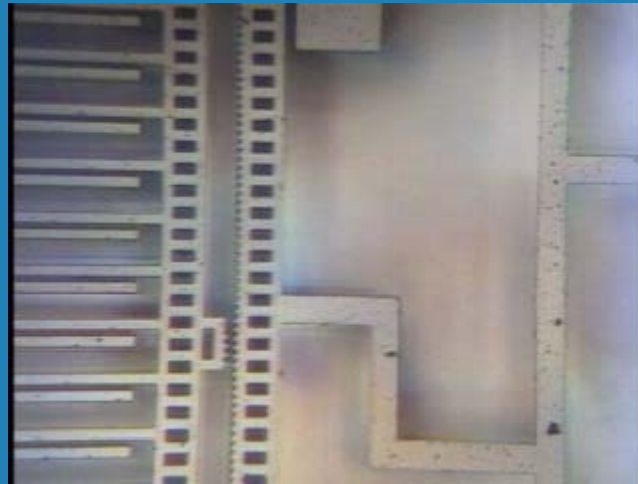


# Aphid on a Micromotor Drive



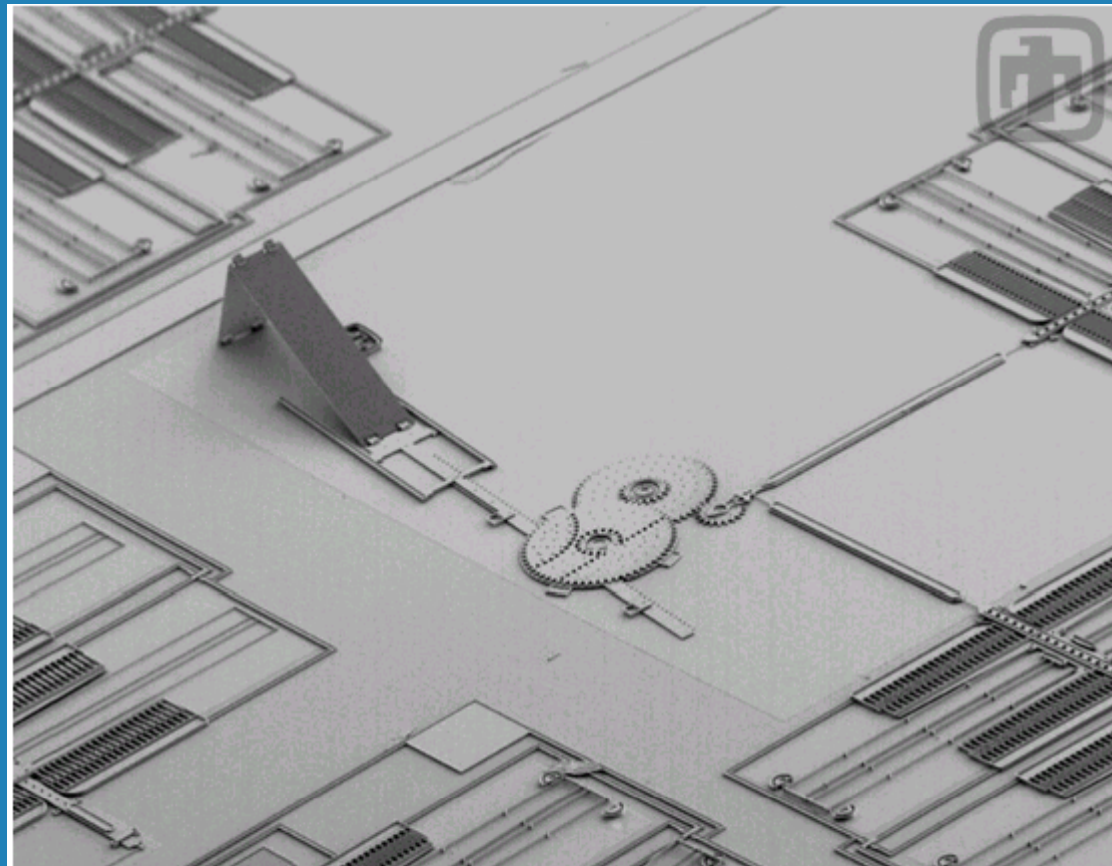
Courtesy: Sandia

# Clutched MEMS Actuator

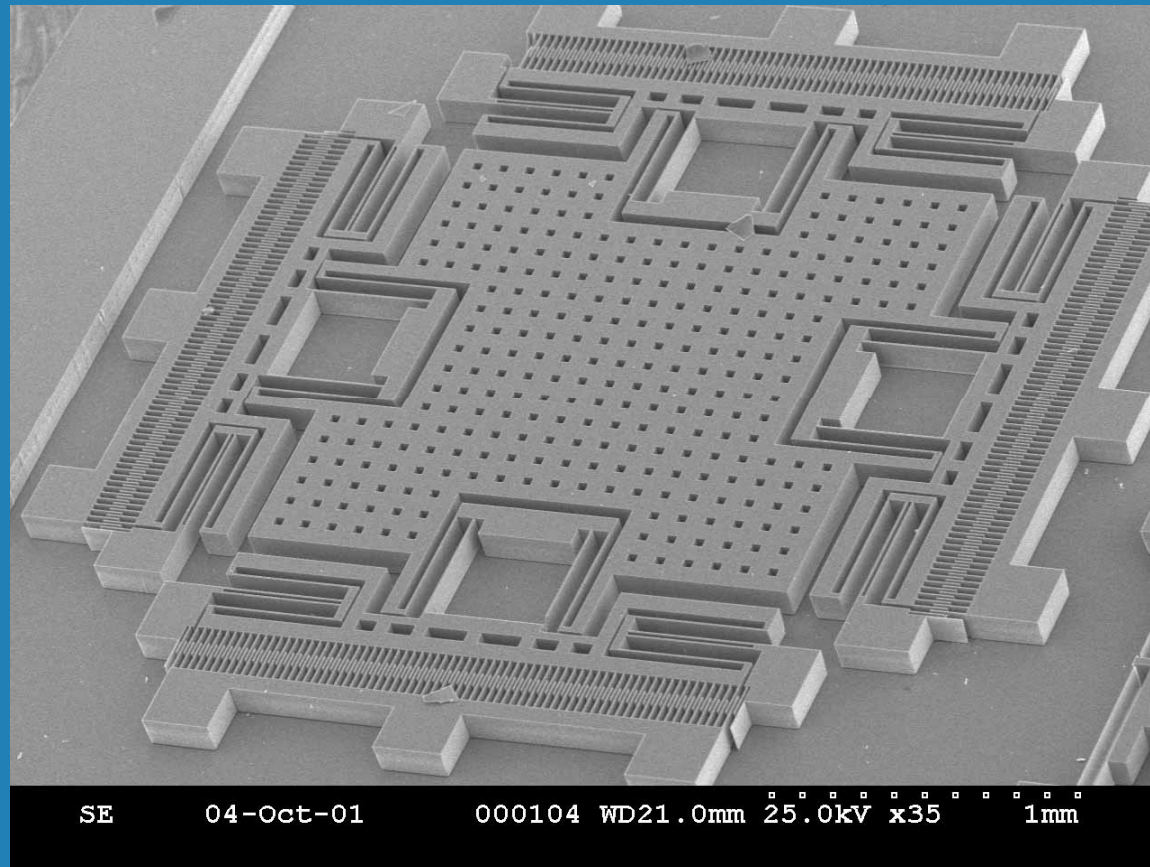




# Movable Micromirror



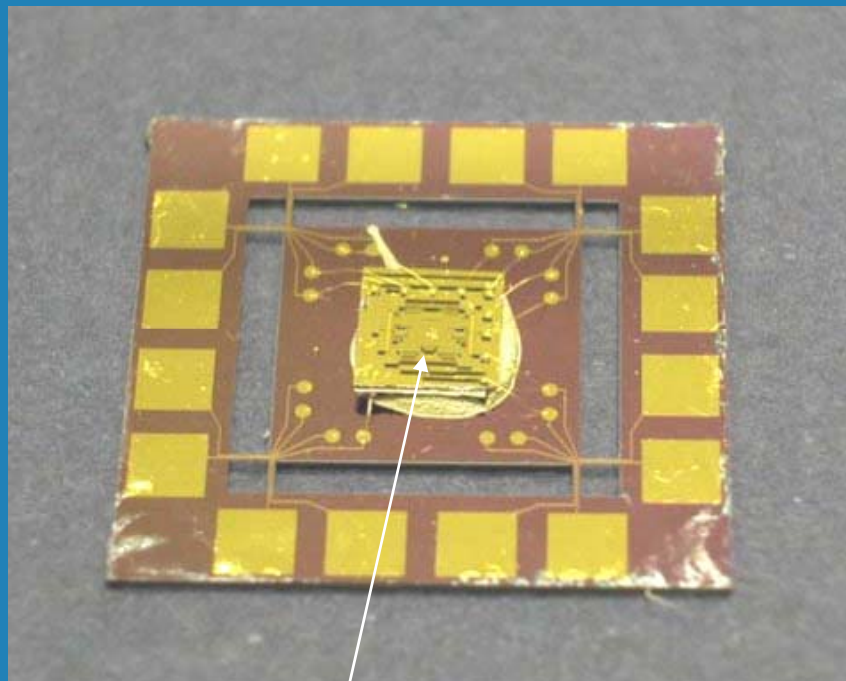
# MEMS Gyroscope (Micromachined Si)



Courtesy: Morgan Research Corporation

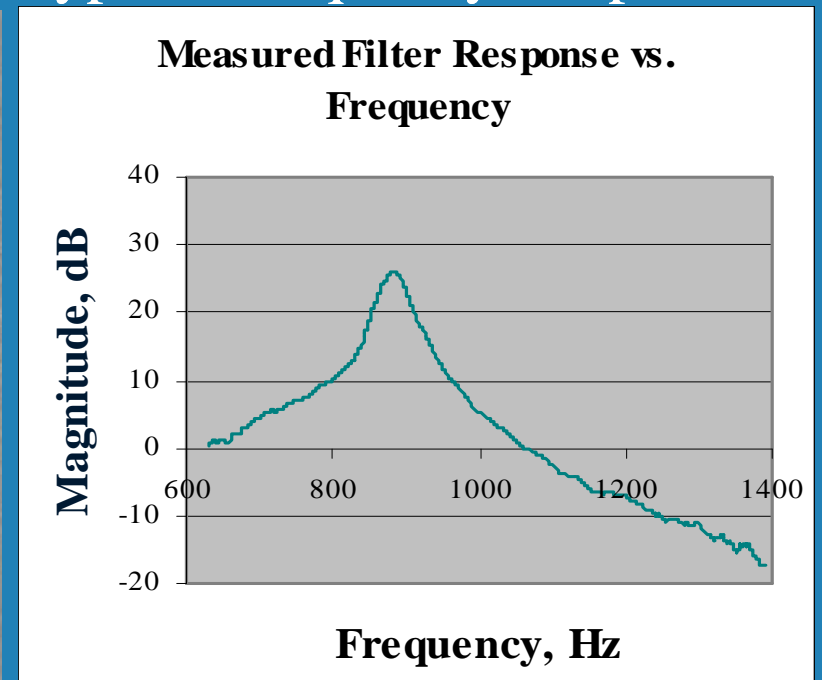
# Bulk Micromachined Vibration Isolation Platform

Device Photograph



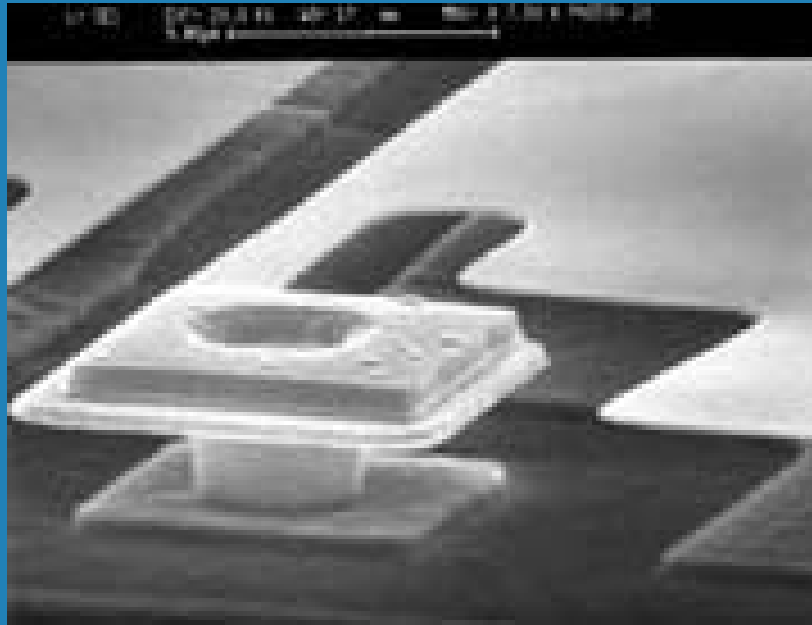
Vibration sensitive MEMS device

Typical Frequency Response



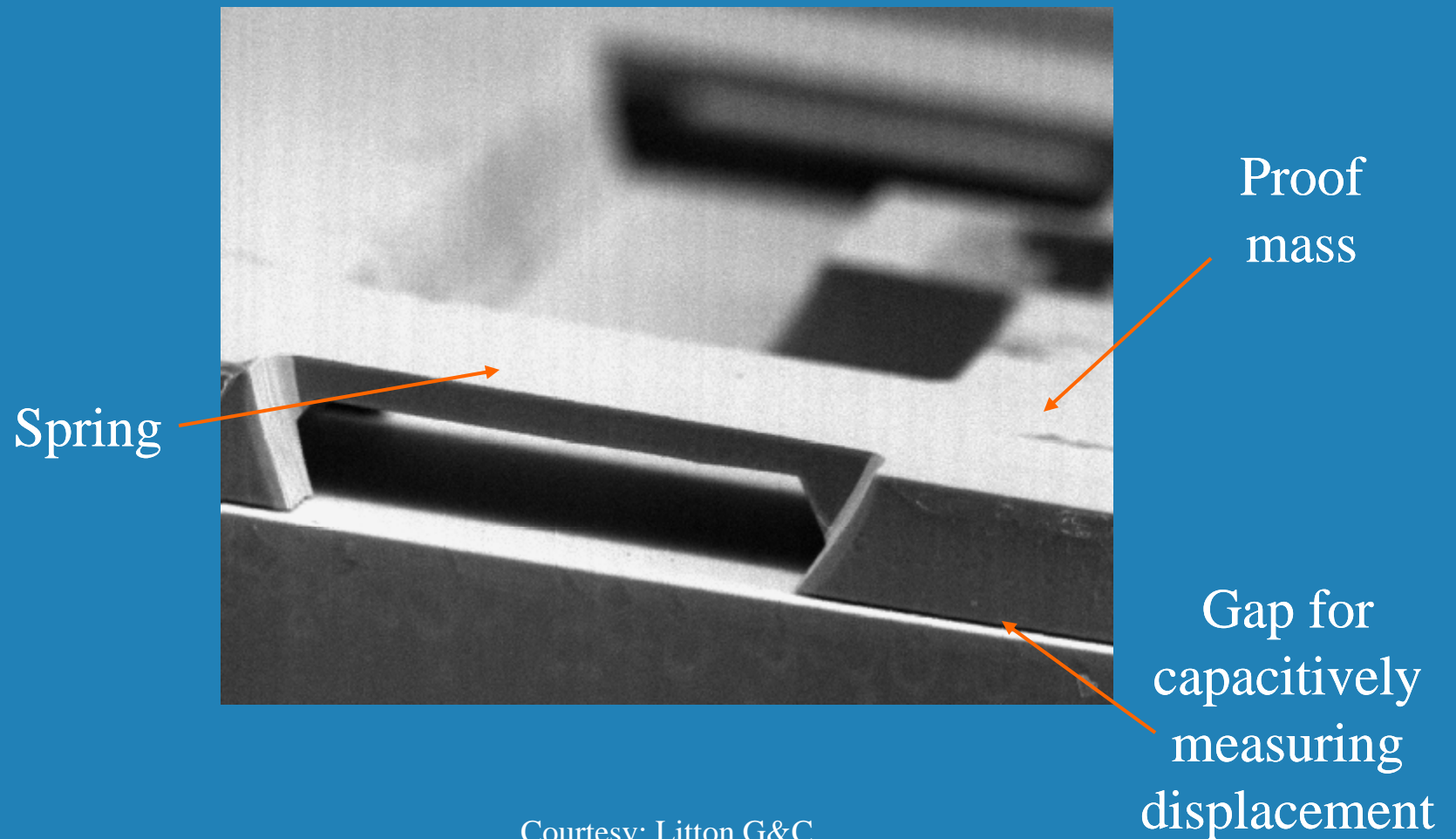
A MEMS spring-mass-damper mechanical low pass filter

# Micromachined Micro-Bolometer



Courtesy: LETI

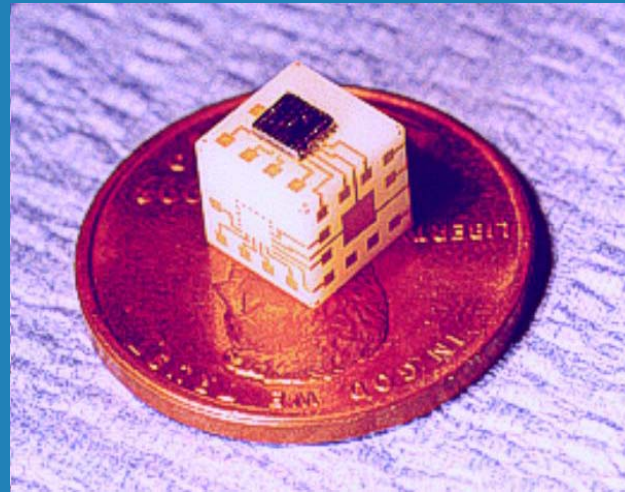
# MEMS Capacitive Accelerometer



Courtesy: Litton G&C

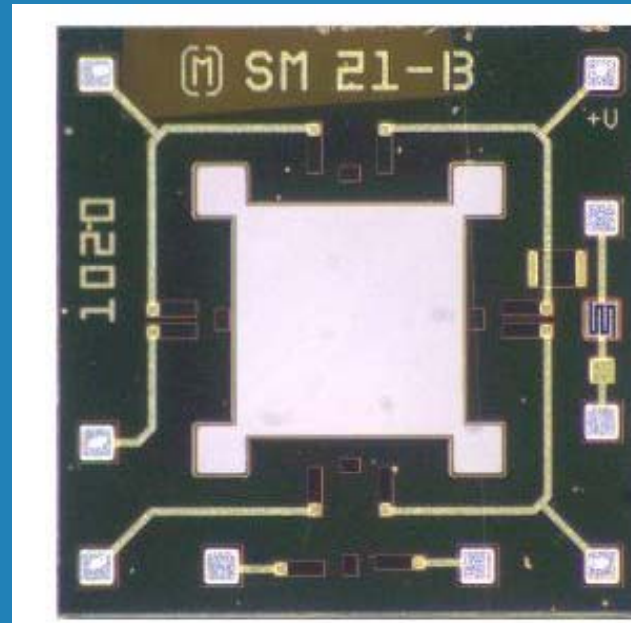


# MEMS Accelerometer Packaged on Tiny Ceramic Cube

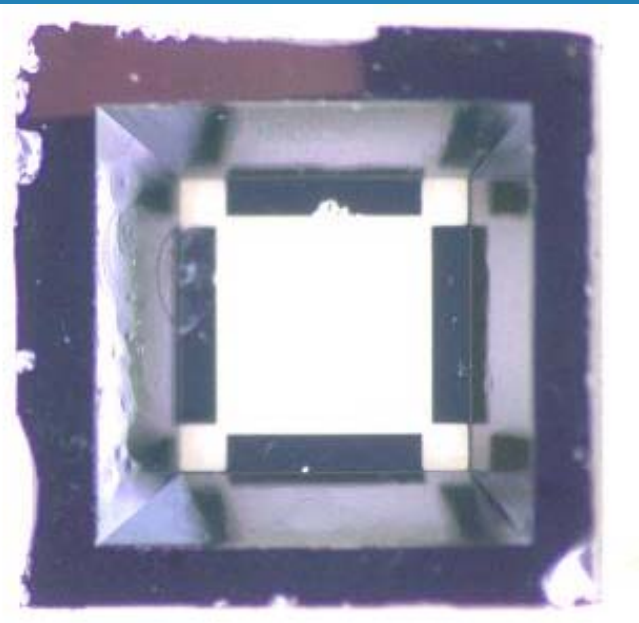


# Hygrometrix HMX2000 MEMS Humidity Sensor

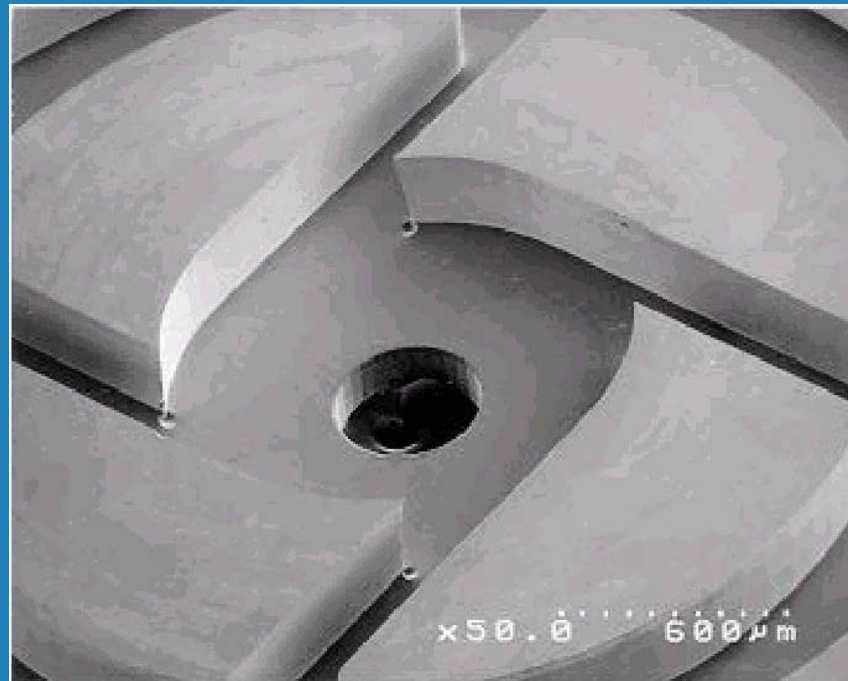
Front side



Back side



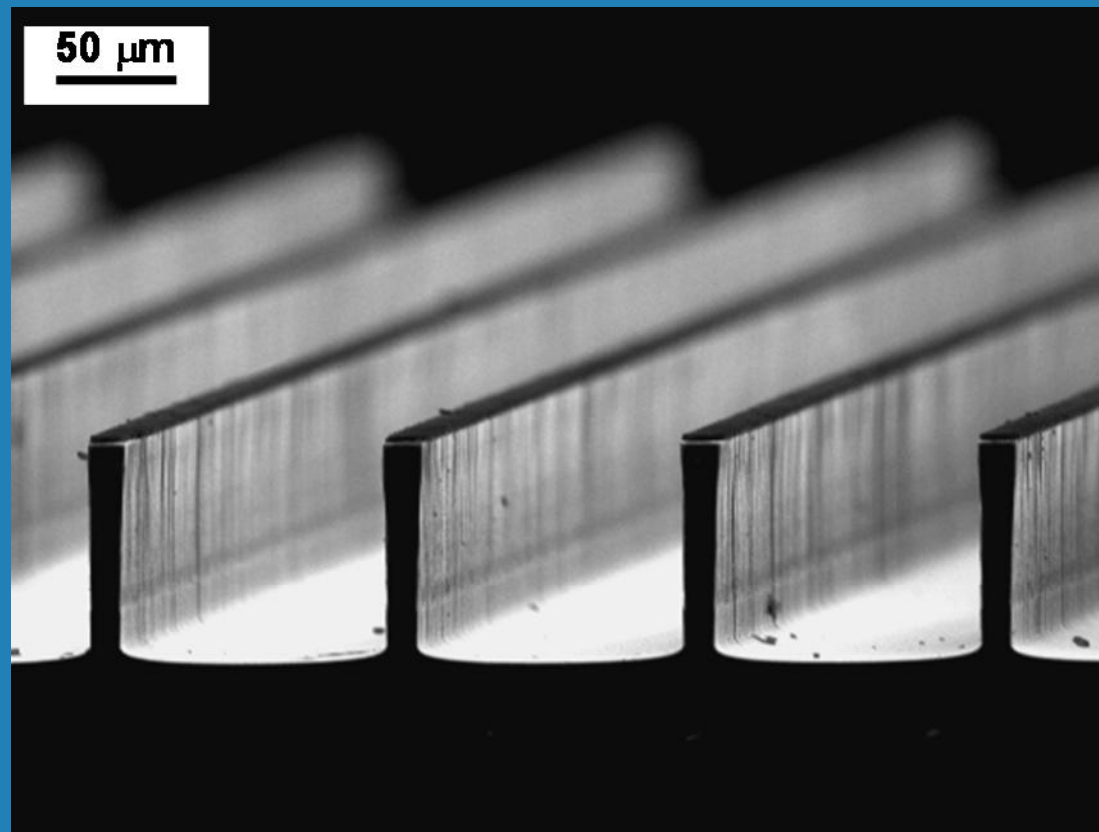
# Micromachined Si Fuel Atomizer



Courtesy: Surface Technology Systems, Ltd



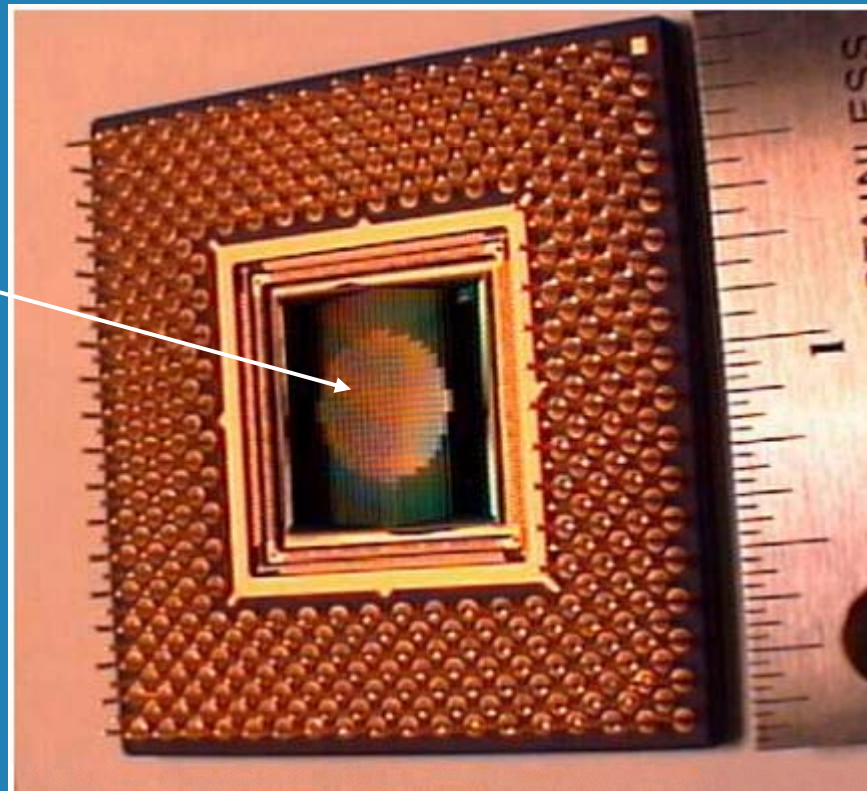
# Microfluidics Flow Channels in Si



# MEMS Micromirror chip

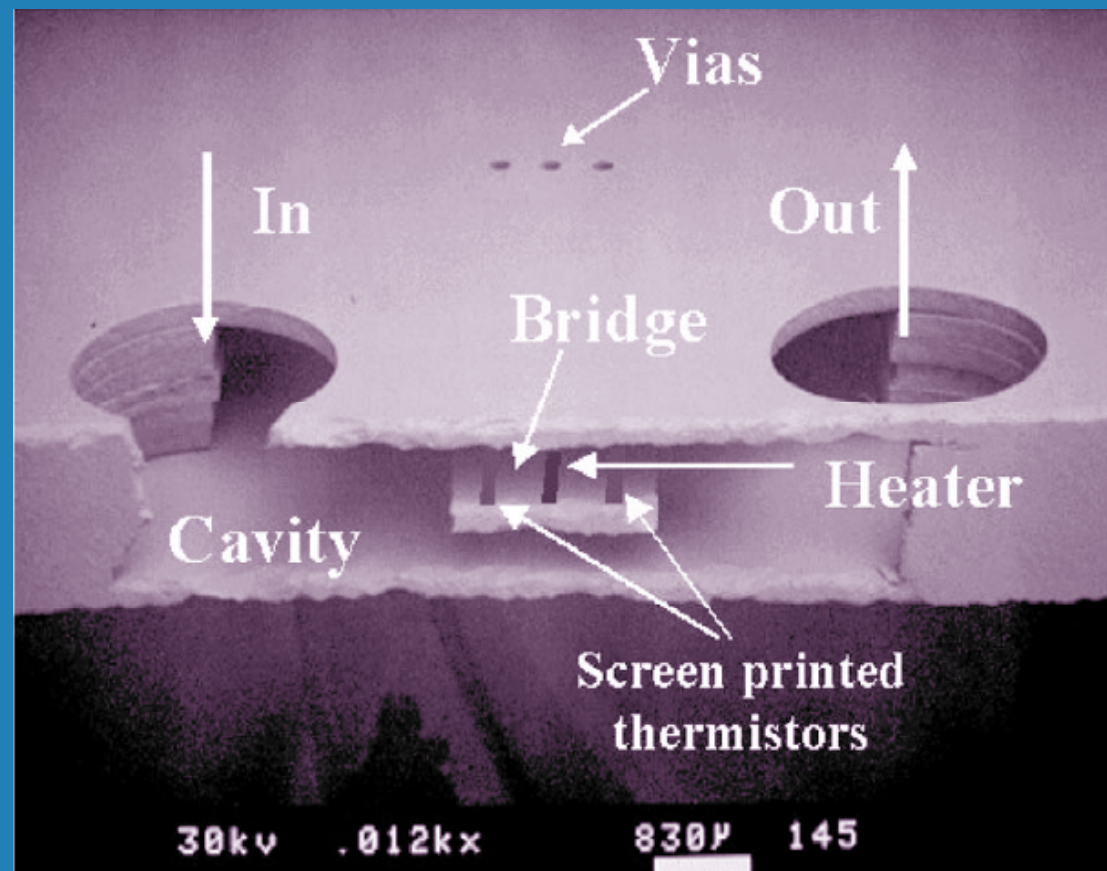
An Array of  
over 300  
parallel plate  
micromirror  
actuators

Designed for  
distortion  
correction in  
optical  
systems



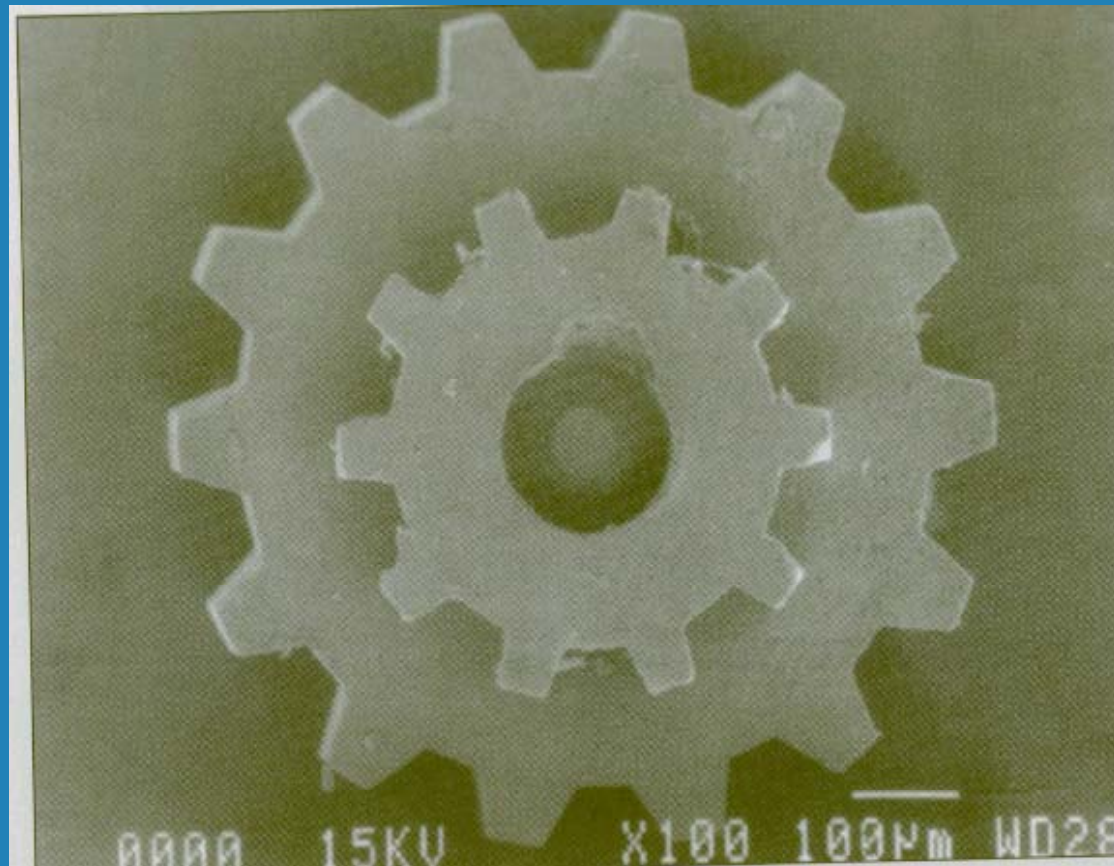
Courtesy: SY Technology, Inc.

# MEMS Gas Flow Sensor in LTCC



Courtesy Gongora-Rubio et al

# LIGA Micro-Gears



Courtesy: Karlsruhe Nuclear Research Center



# LIGA Micro-Gear on Ant's Leg

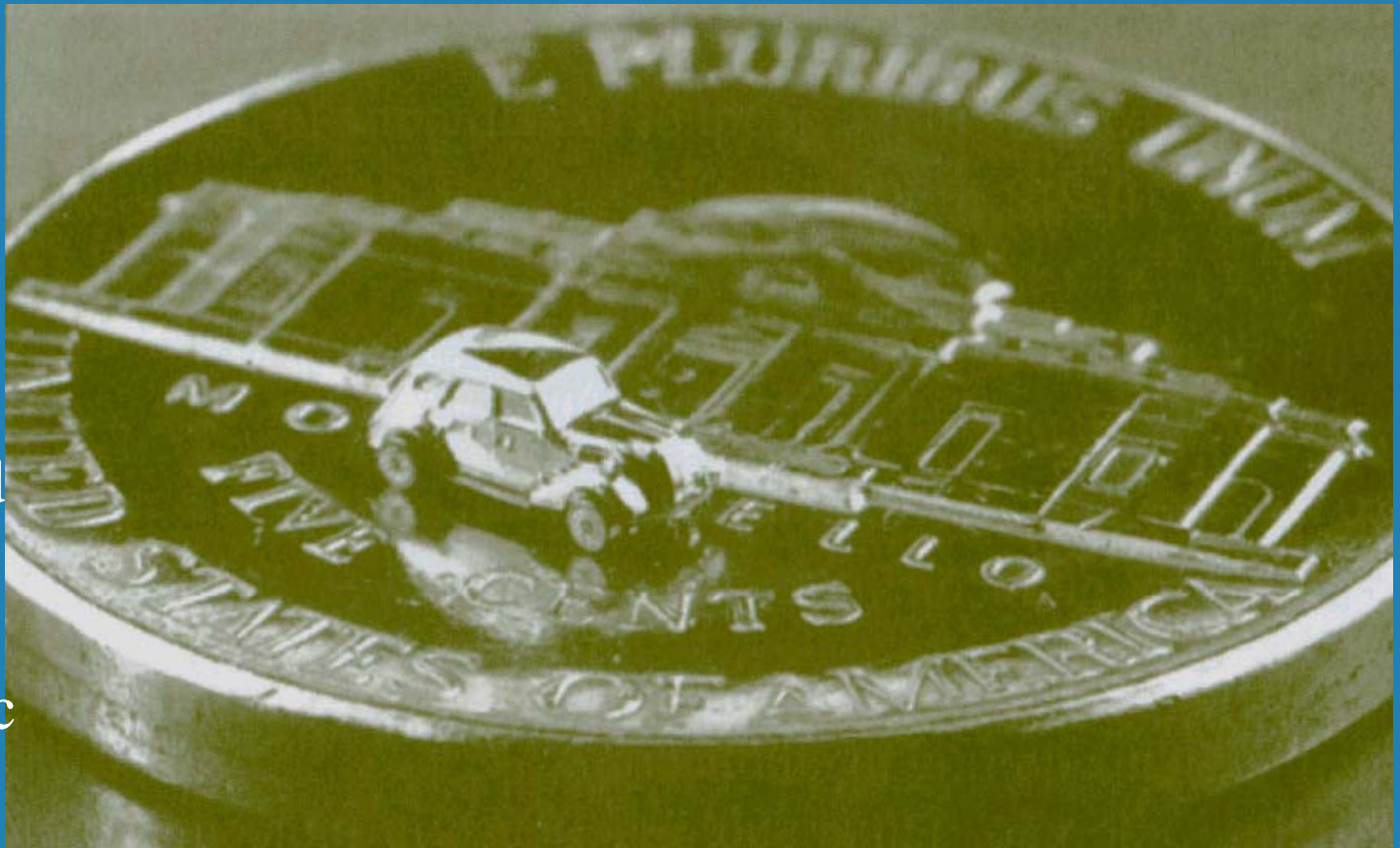


Courtesy: Karlsruhe Nuclear Research Center

# Working Micromachined Electric Car

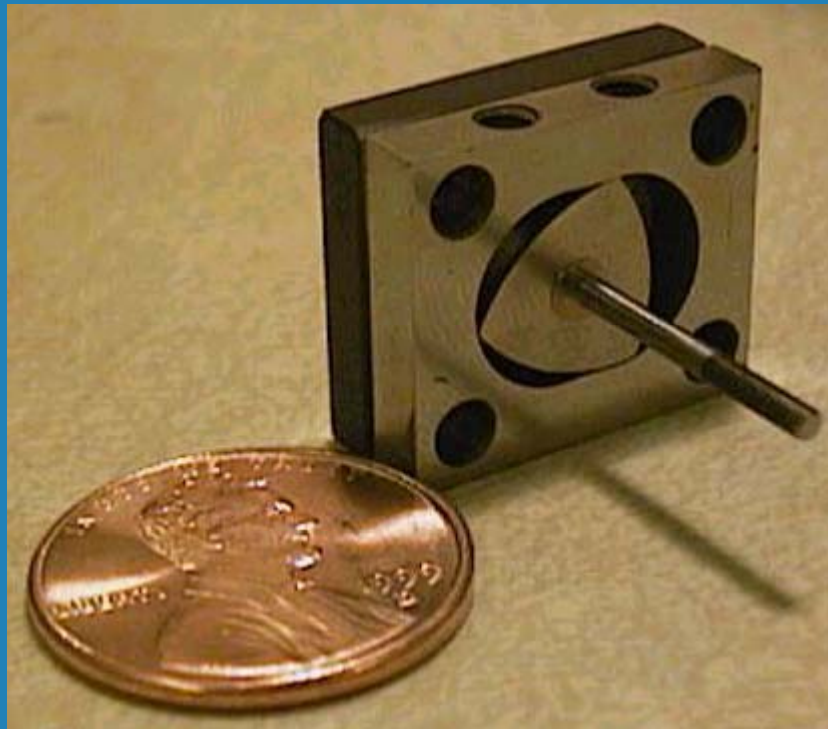
World's  
smallest  
working  
car

Powered  
by a  
remote  
magnetic  
field



Courtesy: Denso Corp

# MEMS Wankel Engine



Courtesy: UC Berkeley



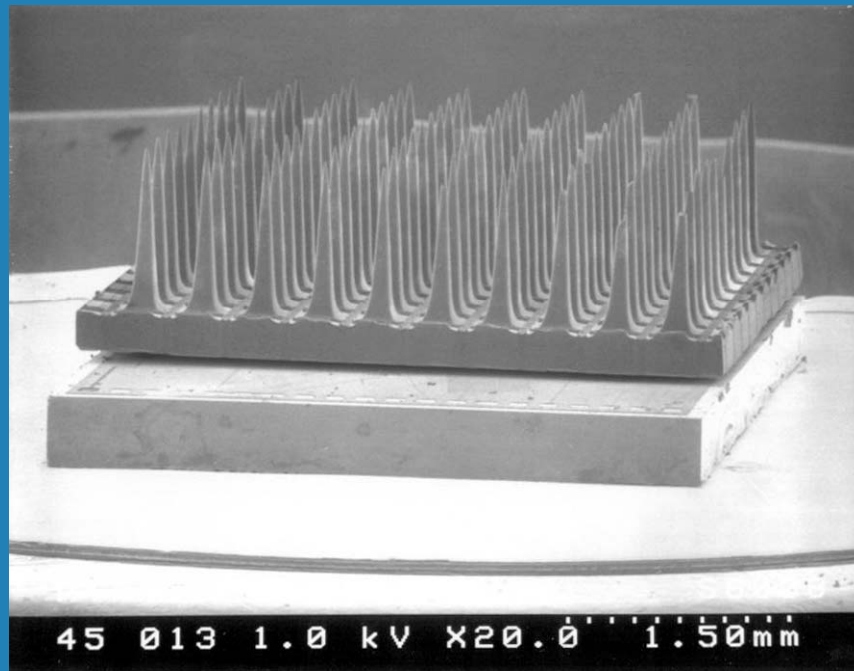
# MEMS Rocket Engine



Courtesy: UC Berkeley

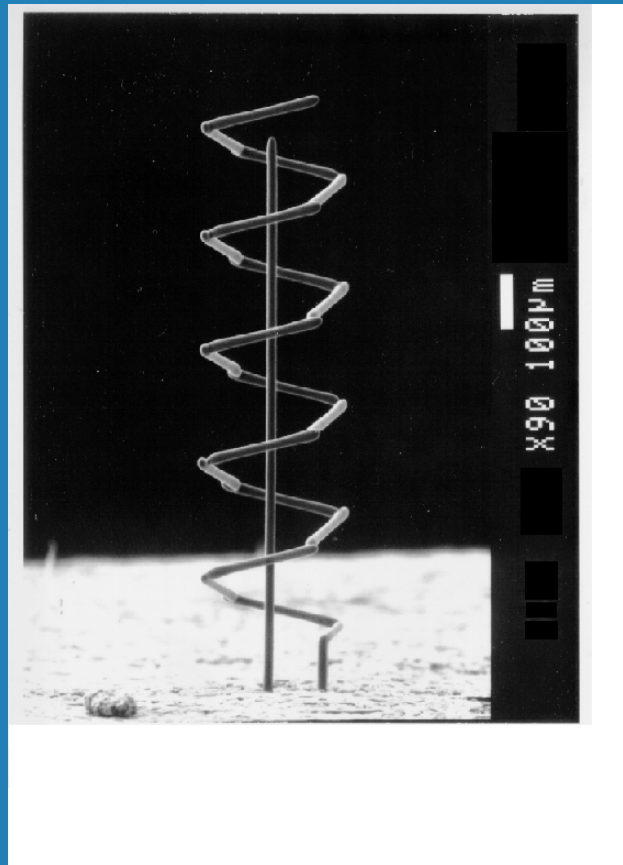


# Si Neural Probe Array



Courtesy: Cal Tech and JPL

# Chip Scale Micromachined Helical Antenna

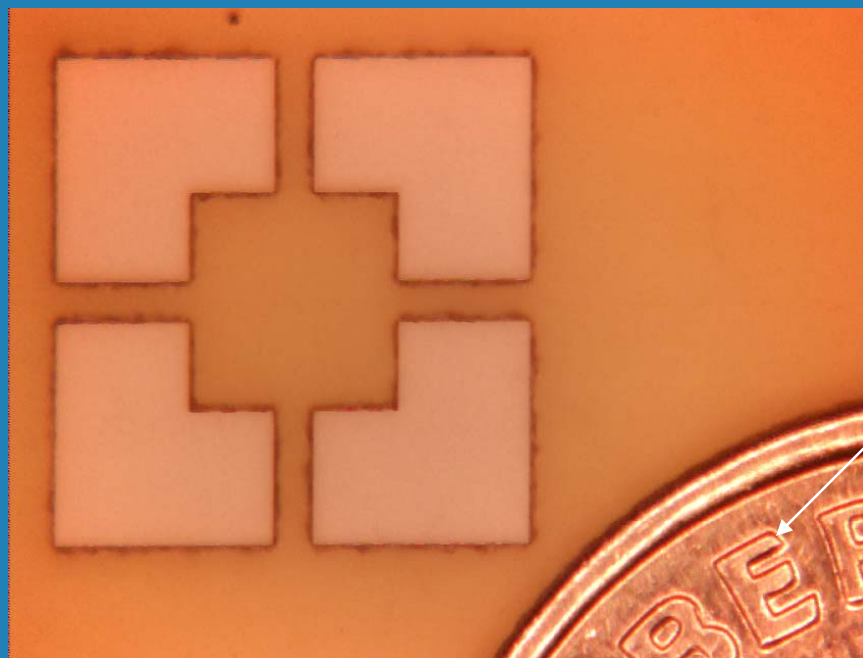


Courtesy: SY Technology, Inc.



# Precision Laser Cutting

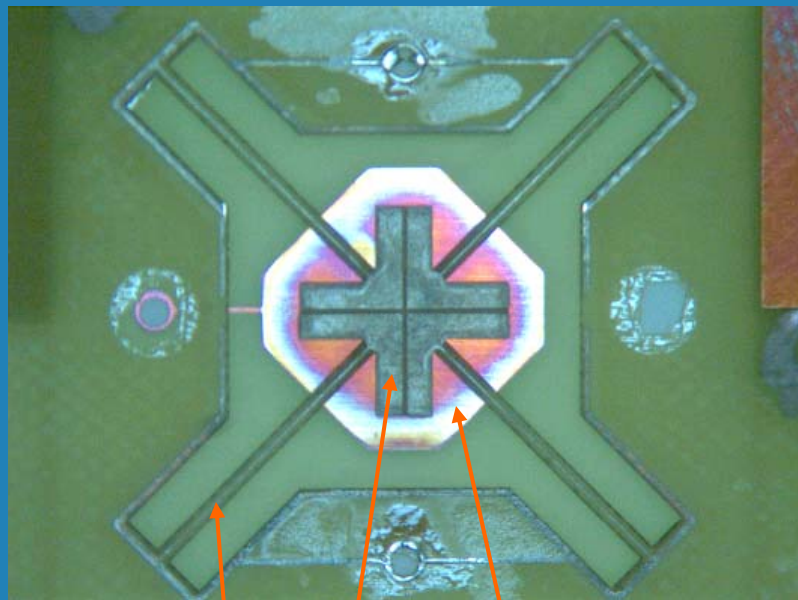
∞ Cutting into or through materials with a high-precision, computer controlled laser



Dime

# A High-G Accelerometer Made in Printed Circuit Board Laminate

Top Layer Removed

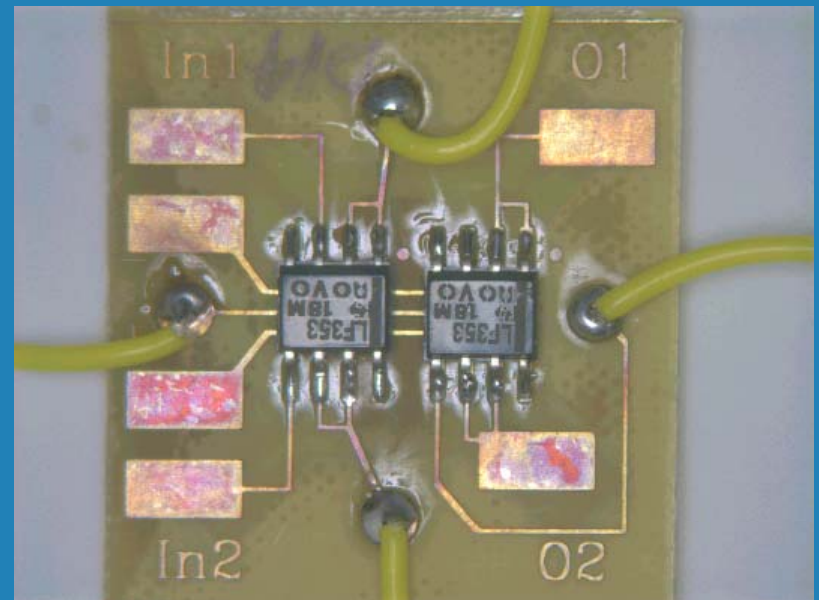


Spring

Proof mass

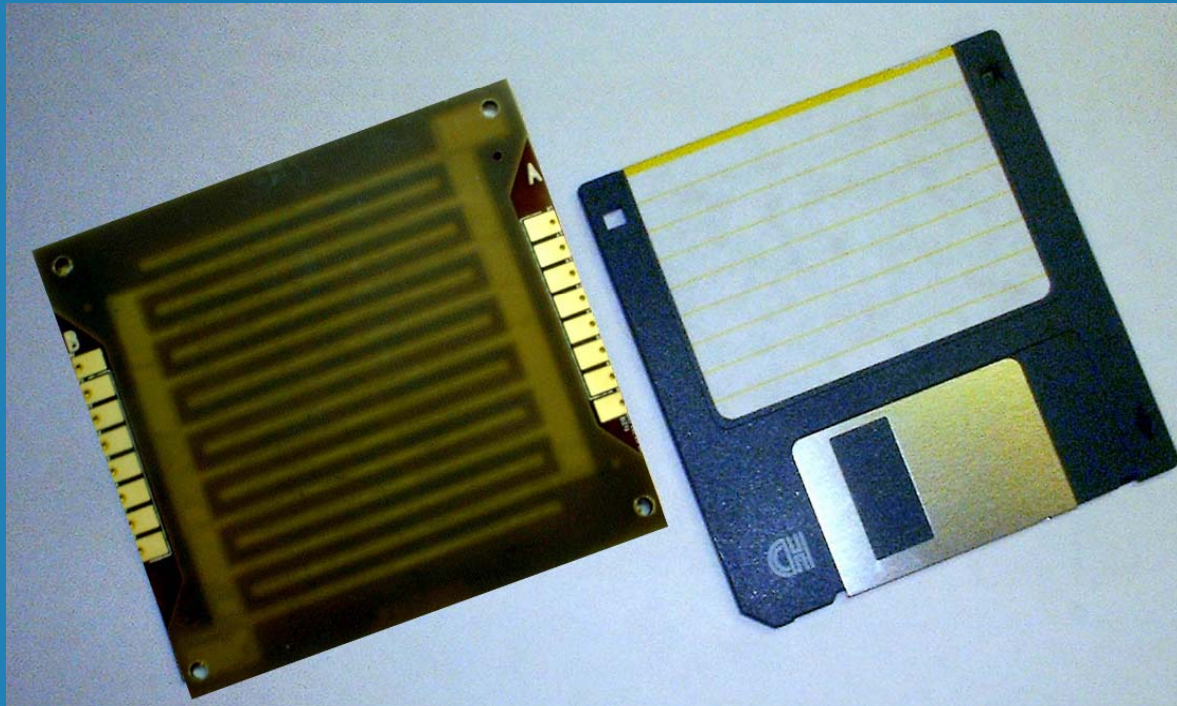
Capacitive position detection

Integrated with Electronics





# Micromachined $H_2$ - $O_2$ Fuel Cell in Laminate



Courtesy: Stanford

# Micro Optics Devices

Positive and  
negative  
microlens arrays



Array of micro  
corner cube  
reflectors



Arbitrary  
surfaces to  
generate various  
optical effects



Courtesy: MEMS  
Optical