



SMALL SENSOR MEASURES VISCOSITY

Patented technique targets automotive oil quality

Based on a recently granted patent, a Microelectromechanical Systems (MEMS) sensor could be used to measure the viscosity, density, temperature and mass flow of motor oil. Integrated Sensing Systems Inc. (ISSYS) was granted US 7,059,176 for a Resonant Tube Viscosity Sensing Device. The first applications of the technology target laboratory viscosity measurement instruments and high-volume, automotive oil quality sensing.

The sensor consists of a micromachined tube fabricated from silicon or other materials, such as quartz or glass. The choice of materials, as well as varying the tube's shape and size, provide the desired flow capacity for the fluid and its vibration parameters. A drive electrode beneath the electrically conductive tube allows the structure to be electrically excited. The tube is driven at or near resonance, with the resonant frequency typically in the range of about 1 kHz to about 100 kHz. Since viscosity is a function of temperature, an integrated temperature sensor measures the temperature of the fluid flowing through the tube.

The quality factor of a vibrating tube is calculated by dividing the resonant peak frequency (in Hertz) by the bandwidth of the peak at 3 dB below the peak. By observing the decay of intermittently-induced resonant vibrations in the tube, or by collecting steady-state data trends, the viscosity of the fluid can be obtained from the quality factor. Data from multiple resonant peaks can provide additional viscosity information.

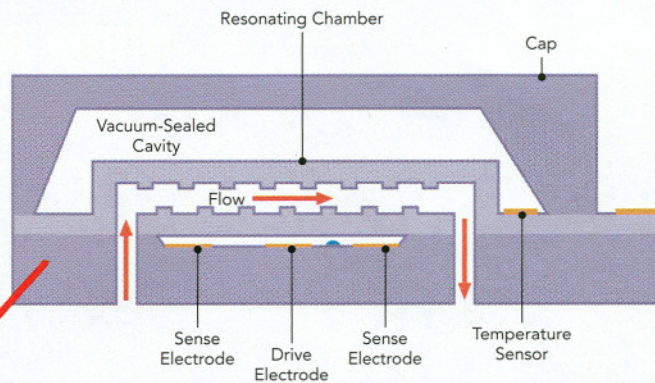
The sensor's design allows it to estimate the viscosity of a

fluid and detect the changes that occur in the viscosity when a lubricant breaks down. For automotive applications, the device can indicate when an oil change is needed. One potential approach involves integrating the sensor with the oil filter so the oil is filtered before testing to prevent particles from clogging the small diameter tube. Because the sensor's package is very thin, it could be mounted to the engine with the same threaded connection used by the oil filter.

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For more information on Integrated Sensing Systems, visit

<http://rbi.ims.ims.ca/4932-518>.



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A micromachined cap and hermetically sealed cavity over the resonating chamber allow it to be driven efficiently at high-quality (Q) values without damping.

