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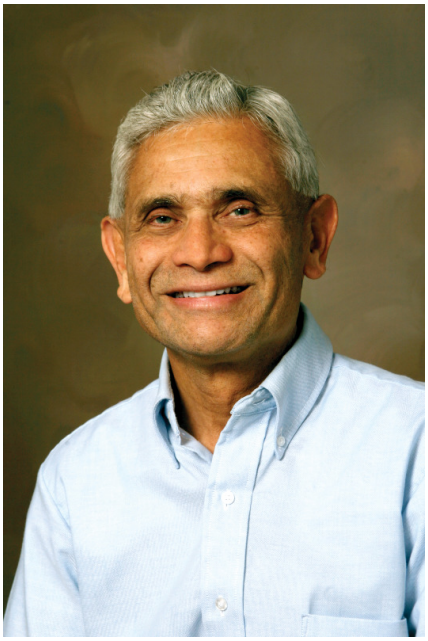
# *Acoustic wave research advances minature low-cost transducers and breakthroughs in ultrasonic flow meters.*

One of the problems with ultrasonic flow meters is that the transducers currently available are generally large and bulky, and also experience significant insertion loss. Recent work done in Marquette University's Solid State Device Laboratory by Dr. Shrinivas Joshi is coupling energy between plate acoustic waves and bulk acoustic waves to create miniature, low cost, high efficiency transducers. Dr. Joshi's groundbreaking research is leading toward a new generation of ultrasonic flow meters that will revolutionize how municipal and industrial users measure the flow of water and other liquids.



*Dr. Shrinivas Joshi*
*Marquette University*

## *Dr. Joshi's Solid State Device Laboratory*

Dr. Joshi leads a team of researchers in Marquette's Solid State Device Laboratory. It is well equipped for the fabrication of silicon based solid-state devices, surface acoustic wave (SAW) devices and sensors, and simple microelectronic circuits. The lab's state of the art test equipment is used to evaluate performance of the fabricated devices at frequencies ranging from dc through the VHF range.

Dr. Joshi's research interests cover the fields of microwave acoustics, solid state devices, and ultrasonic instrumentation. Research projects completed in his laboratory include development of SAW

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(Surface Acoustic Wave) devices for radar and communication applications, and acoustic wave sensors for measuring various parameters such as temperature, pressure, humidity, gas flow, liquid properties, etc. He has received seven patents for inventions related to acoustic wave devices for sensing and signal processing applications.

Through the years, Dr. Joshi has pioneered theoretical and experimental research in the fields of surface acoustic wave devices, sensors, and Lamb wave electronics as well as inventions in these fields, which will allow the development of miniature and low cost sensors for various physical, chemical, and biological systems and mobile-cellular and digital-cordless communications systems.

His expertise in this research just during the last five years is evidenced by 31 refereed journal articles and conference proceedings, publication of a textbook, six patents, and advising numerous graduate students.

Dr. Shrinivas Joshi received a B. E. degree from University of Pune, an M. E. degree from Indian Institute of Science, Bangalore, and a Ph.D. degree from University of California, Berkeley. He joined Marquette University in 1979 as Associate Professor of Electrical Engineering and was promoted to Professor in 1984.

Representative journal publications:


1. S. G. Joshi, B. D. Zaitsev, and I. E. Kuznetsova, "Miniature high efficiency transducers for use in ultrasonic flow meters," J. Appl. Phys., vol. 105, 034501 (2009).
2. I. E. Kuznetsova, B. D. Zaitsev, A. A. Teplykh, S.G. Joshi, and A.S. Kuznetsova, "Power flow angle of acoustic waves in thin piezoelectric plates," IEEE Trans. Ulrason., Ferroelec., Freq. Control, vol. 55, pp. 1984 – 1991, Sept. 2008.
3. I. E. Kuznetsova, B. D. Zaitsev, S.G. Joshi, and A. A. Teplykh, "Effect of a liquid on the characteristics of antisymmetric Lamb waves in thin piezoelectric plates," Acoustical Physics, vol. 53, pp. 557 – 563, 2007.
4. S.G. Joshi, B. D. Zaitsev, I. E. Kuznetsova, A. A. Teplykh, and A. Pasachhe, "Characteristics of fundamental acoustic wave modes in thin piezoelectric plates," Ultrasonics, vol. 44, pp. e787 – e791, Dec. 2006.
5. B. D. Zaitsev, I. E. Kuznetsova, S.G. Joshi, and A. S. Kuznetsova, "New method of change in temperature coefficient of delay of acoustic waves in thin piezoelectric plates," IEEE Trans. Ulrason., Ferroelec., Freq. Control, vol. 53, pp. 2113 – 2120, Nov. 2006.


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