

# **Piezoelectric Sensors, Actuators and Transducers: Design, Fabrication, Characterization and Applications**

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Piezoelectric sensors, actuators, and transducers are known to have high performance, rapid response and low profile, and are becoming increasingly important for smart systems in defense, space, energy, medicine, and robot industries. [1] This tutorial lecture gives an overview on basics and recent development of piezoelectric devices. A wide spectrum of topics will be covered. In specific, Part I will review bulk piezoelectrics and material properties; Part II will focus on piezoelectric sensing, actuation and transduction structures using bulk piezoelectric materials, and the associated structural design, fabrication and characterization techniques; Part III will present recent development on piezoelectric sensors, actuators, and transducers and their applications. Among different piezoelectric devices, piezoelectric transducers will be particularly discussed in detail for energy harvesting, medical ultrasound imaging and therapy. At the end of the lecture, challenges and future trends will be summarized for piezoelectric devices in the world of big data.

[1] Zhang, S., F. Li, X. Jiang, J. Kim, J. Luo, and X. Geng, "Advantages and challenges of relaxor-PbTiO<sub>3</sub> ferroelectric crystals for electroacoustic transducers- a review", *Progress in Materials Science*, 68, 1-66, (2014).