COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING
UNIVERSITY OF MICHIGAN

ME Department Seminar

Flexoelectricity and Electrets

Pradeep Sharma

M.D. Anderson Professor and
Chair of Mechanical Engineering
University of Houston

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Abstract

The ability of certain materials to convert electrical stimuli into mechanical deformation, and vice versa, is a prized property. Not surprisingly, applications of such so-called piezoelectric materials are broad—ranging from energy harvesting to self-powered sensors. In this presentation, I will highlight a relatively understudied electromechanical coupling called flexoelectricity that appears to have implications in topics ranging from biophysics to the design of next-generation soft multifunctional materials. Specifically, I will argue, through computational examples, the tantalizing possibility of creating "apparently piezoelectric" materials without piezoelectric materials—e.g. graphene, emergence of "giant" piezoelectricity at the nanoscale, and (among others) the mechanisms underpinning magnetoreception in certain animals.

Bio

Pradeep Sharma is the M.D. Anderson Professor and Chair of Mechanical Engineering. He also has a joint appointment in the Department of Physics. He received his Ph.D. in mechanical engineering from the University of Maryland at College Park in the year 2000. Subsequent to his doctoral degree, he was employed at General Electric R & D for more than three years as a research scientist. There he worked in two simultaneous programs on Nanotechnology and Photonics apart from basic research in problems of theoretical and computational materials science. He joined the department of mechanical engineering at University of Houston in January 2004. His honors and awards include the Young Investigators Award from Office of Naval Research, Thomas J.R. Hughes Young Investigator Award from the ASME, Texas Space Grants Consortium New Investigators Program Award, the Fulbright fellowship, the Melville medal and the University of Houston Research Excellence Award. He is a fellow of the ASME, the associate editor of the Journal of the Mechanics and Physics of Solids and serves on the editorial board of several other journals.