Abstract: Classical mechanics is intrinsically size-independent and as such does not distinguish between structures that are self-similarly scaled from miles to nanometers. In this presentation, I discuss a specific physical phenomenon (flexoelectricity) that leads to size-effects in electromechanical coupling. I will argue, through computational examples, the tantalizing possibility of creating “apparently piezoelectric” nano-composites without piezoelectric constituents, emergence of “giant” piezoelectricity at the nanoscale, and a peculiar indentation size-effect in ferroelectrics. Finally, I will present evidence indicating the crucial role of flexoelectricity in a major bottleneck underpinning the use of ferroelectric based nanocapacitors used for energy storage.

Biography: Pradeep Sharma received his bachelor’s degree in mechanical engineering from Maharaja Sayaji University of Baroda, India in 1994. He then earned his Ph.D. in micromechanics of materials (mechanical engineering) from University of Maryland at College Park in the year 2000. He also has background in solid state and mathematical physics. Subsequent to his doctoral degree, he was employed at General Electric R & D for more than three years as a research scientist. He joined the department of mechanical engineering at University of Houston in January 2004 as an assistant professor and is currently the Bill D. Cook Associate Professor.

Professor Sharma is interested in theoretical and computational approaches toward understand mechanics and physics of materials. Specifically his research has focused on coupled strain-quantum mechanical behavior in quantum dots and defects, nanoscale piezoelectricity and generalized electromechanical couplings, materials for energy storage, size-effects in elasticity, among others.

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