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# Material is the Machine

## ABSTRACT:

Materials contain features at various length-scales ranging from nanometers to millimeters collectively called the microstructure of the material. In active materials like shape-memory alloys, ferroelectrics and liquid crystal elastomers, the microstructure can change dynamically in response to stimuli including heat, electromagnetic fields, light and stress. This stimulus-responsive microstructural change gives rise to unusual properties, and these can be exploited in a number of applications that convert one form of energy to another. This talk describes some broad principles with examples chosen from liquid crystal elastomers. It also explores the possibility of going beyond either by directly exploiting individual microstructural features as machine elements or combining microstructural changes with structural instabilities in slender structures.



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Kaushik Bhattacharya is Howell N. Tyson, Sr., Professor of Mechanics and Professor of Materials Science as well as the Vice-Provost for Research at the California Institute of Technology. His research concerns the mechanical behavior of solids, and specifically uses theory to guide the development of new materials. He received his B.Tech degree from the Indian Institute of Technology, Madras, India in 1986, his Ph.D from the University of Minnesota in 1991 and his post-doctoral training at the Courant Institute for Mathematical Sciences during 1991-1993. He joined Caltech in 1993. He has held a number of visiting positions across the world, and delivered numerous plenary, keynote and named lectures. He has received the Warner T. Koiter Medal of the American Society of Mechanical Engineering (2015), Young Investigator Prize from the Society of Engineering Science (2004), the Special Achievements Award in Applied Mechanics from the American Society of Mechanical Engineers (2004) and the National Science Foundation Young Investigator Award (1994). He has served as the fifth editor of the Journal of the Mechanics and Physics of Solids (2004-2015). He has over 50 doctoral students and postdoctoral scholars, many of whom hold leadership positions in academics, industry and national laboratories.