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Fundamental Theory of Nanogenerator JAMES CHEN, JAMES LEE, Department of Mechanical and Aerospace Engineering, The George Washington University — Developing novel technologies for nano-devices is crucial for applications in biomedical sensing, environmental monitoring and personal electronics. Miniaturization of self-powering devices is the key challenge both experimentally and theoretically. Various approaches have been developed for harvesting energy from the environment based on thermoelectricity and piezoelectricity. Innovative nanotechnologies have been developed for converting mechanical energy into electric energy experimentally. It is noticed that theoretically, at nano scale, the physical phenomena can not be explained by classical continuum physics; instead one should resort to atomistic descriptions. An Atom-Embedded Continuum Theory has been developed for calculating piezoelectric and thermoelectric potential distribution. This theory is an alternative to molecular dynamics (MD) simulation in studying statistical and finite temperature properties of materials. Atomistic representations of fundamental physical quantities are defined; balance laws are formulated. Examples are presented to show the polarization distribution in a nanowire made of Barium Titanate by (1) mechanical loading and (2) temperature gradient.

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