Interplay between Phononic Bandgaps and Microstructured Materials for Energy-Harvesting and Efficiency in Transportation

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In this talk, we will identify research issues and opportunities to make alternative energy sources viable and to improve energy efficiency via reduce energy consumption in transportation and household energy consumption through advanced materials, mechanics, heat transfer, design and manufacturing, thereby leading to the conservation of fossil fuels and reduction of carbon dioxide emissions. The proposed framework is suitable for many complex engineering systems like nano-composite tires, electro-active polymers, piezo-electrics, or thermal-electric (TE) materials that offer society the potential for massive economic savings and significant stress reduction on the environment. Specifically, TE's may be used in automotive, aerospace, or solar energy applications where 65% of energy becomes waste heat. If we can convert just 10% of this waste heat to electric energy through intelligent nano-reinforcement of TE materials, billions of dollars in energy loss can be saved or an industry like solar energy, which has gained momentum recently but still lacks the efficiency requisite of replacing fossil fuels, may become a more viable energy alternative. It is noted that if the weight of a standard automotive tire can be reduced 30% or if the same tire's rolling resistance can be decreased 50%, multi-billion dollar savings will be realized through reduced fuel consumption by the public.