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Phonon Transport in Carbon Nanotubes G. PENNINGTON, S.J. KILPATRICK, A.E. WICKENDEN, Army Research Laboratory — An understanding of phonon transport in carbon nanotubes (CNTs) is important considering potential electronic and thermal management applications. Weak intrinsic phonon scattering in these quasi-one-dimensional materials allows unique properties including high thermal conductivity. Thus CNTs may provide novel thermal management solutions critical for many emerging electronics technologies, including the development of high-power, high-temperature transistors/lasers and the continued scaling down of feature sizes in high-performance microelectronics. Carbon nanotubes are also expected to exhibit relatively large optical phonon decay times. It is widely believed that non-equilibrium phonons lead to conductance degradation, negative differential conductance, and enhanced thermal breakdown of suspended CNTs.[1] Furthermore, absorption of hot optical phonons by conducting carriers would significantly alter device characteristics in the low-field ballistic limit. Thermal properties are also affected as the slow decay of hot optical phonons is expected to lead to reduced thermal diffusivity, and the development of inhomogeneous heating within a nanotube. In this talk, we discuss simulations of CNT phonon transport based on Monte Carlo solution of the phonon Boltzmann transport equation. [1] E. Pop, D. Mann, J. Cao, Q. Wang, K. Goodson, and H. Dai, "Negative Differential Conductance and Hot Phonons in Suspended Nanotube Molecular Wires," Phys. Rev. Lett., vol. 95, pp. 155505-8, October 2005.

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