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Novel Parametric Actuation Scheme in Piezoelectric NEMS RASSUL KARABALIN, SOTIRIS MASMANIDIS, California Institute of Technology, RON LIFSHITZ, Tel Aviv University, MICHAEL CROSS, MICHAEL ROUKES, California Institute of Technology — Resonant nanoelectromechanical systems (NEMS) are attracting interest in a broad variety of applications ranging from ultrasensitive mass and force detectors to quantum limited devices. However, an efficient, fully integrated scheme for actuation and detection remains a challenge. This talk reviews our recent progress in addressing this problem. First, we obtain excellent actuation efficiency using multilayered piezoelectric nanostructures. Second, we employ the piezoelectric properties of these structures for parametric amplification of mechanical motion. Finally, we excite arrays of coupled NEMS resonators and find that their response agrees with theoretical predictions. We use such parametrically-driven resonant devices to demonstrate a thousand-fold amplitude gain, as well as a significant quality factor enhancement, both in vacuum and in air, suggesting that this scheme may provide significant improvement to sensor performance.

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