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Thermal Noise-Limited Detection of Radio-Frequency Piezoresistive Nanoelectromechanical Systems IGOR BARGATIN, EDWARD MYERS, JESSICA ARLETT, BEN GUDLEWSKI, MICHAEL ROUKES, California Institute of Technology — We have developed a method of measuring RF-range resonance properties of nanoelectromechanical systems (NEMS) with integrated piezoresistive strain detectors by using the piezoresistor as a signal downmixer. The technique takes advantage of the high strain sensitivity of semiconductor-based piezoresistors, while overcoming the problem of RF signal attenuation due to a high source impedance. Our technique also greatly reduces the effect of the cross-talk between the detector and actuator circuits. Using this technique, we achieve thermomechanical noise detection of cantilever resonance modes up to 71 MHz at room temperature, demonstrating that piezoresistive detection is a viable high-sensitivity alternative to current methods of displacement detection in high-frequency NEMS.

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