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Nanoscale Motion Detection by Diffraction of Evanescent Waves P. SCOTT CARNEY, Dept. of Electrical and Computer Eng., University of Illinois at Urbana-Champaign, DEVREZ KARABACAK, Dept. of Aerospace and Mechanical Eng., Boston University, STEPHEN B. IPPOLITO, M. SELIM UNLU, Dept. of Electrical and Computer Eng., Boston University, KAMIL L. EKINCI, Dept. of Aerospace and Mechanical Eng., Boston University — Conventional optical techniques such as Michelson interferometry and Fabry-Perot interferometry have been widely used for ultrasensitive motion detection in micro- and nanoscale mechanical devices. Here, we propose a novel motion detection scheme based upon the diffraction of evanescent waves. In this scheme, an evanescent field is formed within the vicinity of a moving device surface. The motion of the surface results in an enhanced scattering of the evanescent field into propagating states. This novel detection scheme appears to have several advantages over conventional techniques: it lowers the background optical signal; if implemented using a solid immersion lens, the effective spot size is reduced. We shall describe a possible implementation of a darkfield microscope for motion detection in a nanomechanical resonator and present numerical analyses.

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