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Solid Immersion Lens Microscopy Techniques for Enhanced Optical Displacement Detection in Nanoelectromechanical Systems D. KARABACAK, T. KOUH, Dept. of Aerospace and Mechanical Eng., Boston University , M.S. UNLU, B.B. GOLDBERG, Depts. of Physics and Electrical and Computer Engineering, Boston University, KAMIL EKINCI, Dept. of Aerospace and Mechanical Eng., Boston University — Nanoelectromechanical systems (NEMS) are drawing interest from both technical and scientific communities. These are electromechanical systems — much like Microelectromechanical Systems (MEMS) — mostly operated in their resonant modes, with dimensions in the deep submicron. Among the remaining technological challenges in NEMS operation is the detection of sub-nanometer displacements of these devices at high frequencies. Recently, optical interferometry techniques have been applied to displacement detection in NEMS operated at room temperature. However, the displacement sensitivity of such techniques degrades rapidly in the domain of NEMS where the diffraction limited optical spot size is much larger than the relevant device dimensions. Here, in an effort to remedy the aforementioned shortcomings, we integrate a solid immersion lens (SIL) to a sub-wavelength NEMS resonator, and demonstrate enhanced optical displacement sensitivity. The authors gratefully acknowledge support from the NSF under grants No. 210752, 216274 and 324416.

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