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Ultra-Sensitive Micromechanical Cantilevers with Integrated Magnetic Structures MICHELLE D. CHABOT, University of San Diego, JOHN M. MORELAND, NIST Boulder, LAN GAO, SY-HWANG LIOU, University of Nebraska, Lincoln, CASEY W. MILLER, University of Calfornia San Diego — We report on the design, fabrication, and implementation of ultra-sensitive micromechanical oscillators. These novel devices have been developed for use as cantilever magnetometers and as force sensors in nuclear magnetic resonance force microscopy. Our single-crystal silicon cantilevers with integrated magnetic structures are fabricated using a novel process in which magnetic film patterning and deposition are combined in a nondestructive manner with cantilever fabrication. Current magnetic moment sensitivity achieved for the devices, when used as magnetometers, is 10^{-15} J/T at room temperature. Finite element modeling was used for several different cantilever geometries to improve design parameters, ensure that the devices meet experimental demands, and correlate mode shape with observed results. Post-fabrication focused-ion-beam milling was used to further pattern the integrated magnetic structures when nanometer scale dimensions were required.

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