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Development of a Capacitive Measurement Apparatus for Steel Alloy Magnetostriction CHRISTOPHER L. MILBY, JOSEPH L. WIEWEL, MATTHEW W. BECKNER, Department of Physics, Western Illinois University, MARK S. BOLEY, Dep't of Physics, Western Illinois University — In our laboratory we have developed steel alloy torque transducers that operate via a magnetoelastic principle, converting applied stress to an external magnetic field signal subsequent to appropriate magnetic pre-conditioning. We have found that linearity, repeatability, and sensitivity of these transducers is highly dependent on the nickel and chromium content of these alloys which is directly linked to the extent that these materials enhance or degrade the "engineering magnetostriction coefficient" of the alloy; therefore its measurement is fundamental to the application of these alloys. In our present apparatus, we applied a large current to produce a saturating axial magnetic field in the sample, which was physically connected to change the capacitance between two large adjustable plates, then related this change to a capacitance bridge voltage to ascertain a sample dimensional change on the order of ppm. Values agreeing with previously measured coefficients were found for pure nickel, while values in qualitative agreement with the magnetoelastic sensitivity of several steel alloys applied in magnetic torque sensing technology were also found, confirming that our apparatus can predict the optimal materials for magnetic torque sensing.

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