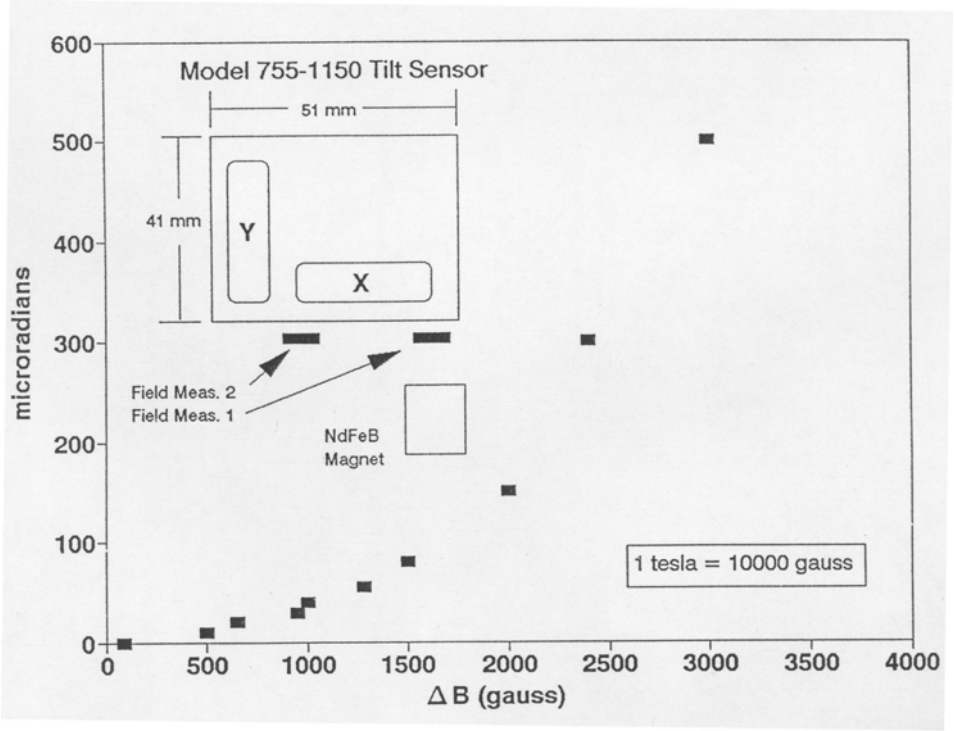
Effect of Magnetic Fields on Applied Geomechanics Tilt Sensors

It is sometimes necessary to measure tilt (rotation) in the presence of a strong magnetic field. Strong fields have no effect on the output of our electrolytic tilt sensors when the gradient between the two ends of the sensor is less than about 14 gauss/mm. Larger gradients along the length of the sensor produce an output shift. The following experiment, performed by Dr. Todd Johnson of Fermilab, illustrates the effect.

NdFeB magnet was held near one end of the X transducer of a biaxial Model 755-1150 High-Gain Miniature Tilt Sensor while the 755-1150 was operated by a Model 781 Signal Conditioning Unit. The field strength was measured at each end of the transducer. The magnet was then moved away from the transducer and the measurements made again. This procedure was repeated several times. Each time the difference in field strength, ΔB, was computed by subtracting measurement 2 from measurement 1. The conditioned output of the transducer also was measured at each magnet position and converted to microradians. The output (indicated tilt) was then plotted vs. ΔB. The graph below shows that the field gradient begins to effect the output when $\Delta B \approx 500$ gauss (gradient $\approx$ 14 gauss/mm = 1.4 tesla/m), for which the output shift is about 10 microradians. The effect grows exponentially as the gradient increases, until the output shift is about 500 microradians at $\Delta B \approx 3000$ gauss (gradient $\approx$ 86 gauss/mm = 8.6 tesla/m). Magnet polarity is irrelevant. The sensor was undamaged by the large magnetic gradients and continued to function normally after the test.

These results indicate that Applied Geomechanics electrolytic tilt sensors may be used successfully in strong magnetic fields after taking the effect of gradients into consideration.



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