Design and Analysis of Linear Incremental Encoder Based on Back Magnetic TMR Sensors

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Abstract—In the automation of advanced industrial processes, the production equipment must be highly accurate, intelligent and efficient to achieved green technology. Hence, the equipment must exhibit information of stable, accurate and prompt position and velocity of the workpieces. Among the mechanical motions of the equipment, linear motion is the most fundamental and important actuation needed to be monitored. In this paper, a rugged and accurate linear position sensing system based on Tunneling Magneto-Resistance (TMR) sensing elements is proposed to fulfill the properties. Compared with other position sensing technologies, magnetic sensing technology can preserve accuracy and reliability in harsh environments. And, magnetoresistive (MR) sensors show good performance in sensitivity, stability, energy consumption, compactness, and response time. Especially in recent technology achievement, TMR sensors have the potential to deliver the best performance. With commercial CAE software packages, a linear incremental back magnetic TMR scale is modelled. And, sensitivity analysis in design parameters is conducted to meet the design specifications. Finally, an linear incremental encoder is prototyped based on the CAE analysis results.