## From inception to completion, magnetism was the attraction

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From the early stage of being an ingenuously scientifically curious minded individual (creating a small electromagnet yourself by connecting the ends of a copper wire to the positive and negative ends of a cell battery), down to the more conscious decisions of personally developing the skills and tools to learn one or more of the many engineering fields of study, there exist direct and constant contact with the interesting phenomenon exhibited by magnetic materials. Faraday's Law of Induction dominates almost every aspect of our domestic and industrial environment, ranging from electric fans, microwave ovens, air conditioners, food processors, washing machines, and heavy equipment driven by motors. The interaction between magnetic materials on the magnetic flux lines has virtually found relevance in most engineering applications. Computer systems are essential for processing data at the competitive speed and accuracy in this time and age, equally important is an inexpensive means for storing the processed data. This is mostly an application of magnetizing tiny magnetic domains on the disc as in the case of using floppy disks, magnetic tape, and hard disk drives. In addition to storage, the transmission of data from one device to the other is also a function of electromagnetic radiation e.g. Bluetooth technology. Recent advances in research and development have led to the realization a "proof of concept" for magnetic field human body communication system which uses the body as a vehicle to deliver magnetic energy between electronic devices in the absence of a power boost typically used to overcome the signal obstruction. This technology offers 10 million times lower energy level compared to those associated with Bluetooth radios. At the undergraduate level, I was exposed to the concept of antenna theory, which not only borders on telecommunication transmitter-receiver applications, but also biomedical imaging such as MRI. Further postgraduate studies in Engineering Control Systems and Instrumentation brought out in the open the significance of electromagnetic induction based actuators in experimental and model-based projects. The relevance of magnetic materials and magnetism became even more pronounced in doctoral research project work related to railway research. The application of magnetism in railway industry has indeed proven to be successful in condition monitoring by means of magnetic flux leakage (MFL) inspection technique, which focuses on magnetizing the rail and then correlating exit points (poles) to the presence, severity, and location surface defects on rails. More revolutionary to the conventional train track interaction is the utilization of the behavior of similar and opposite poles for propulsion/levitation of the train on the track (maglev train). The combination of a large electrical power source, metal coils lining a track, and large guidance magnets attached to the underside of the train enables Maglev trains to attain speeds above the threshold 1000 [km/h] and a levitation of between 1 and 10 [cm] above the track. The novelty of the maglev technology lies in the substitution of fossil fuels, which is replaced by the magnetic field created by the electrified coils in the track and underside of the vehicle which combine to propel the train in the direction of motion. As a direct consequence of my personal experience with magnetism related works, it is safe to say that it is not only the different polarity of magnetic materials that experience attraction but also the science and engineering world is bound to the field of electromagnetism.

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