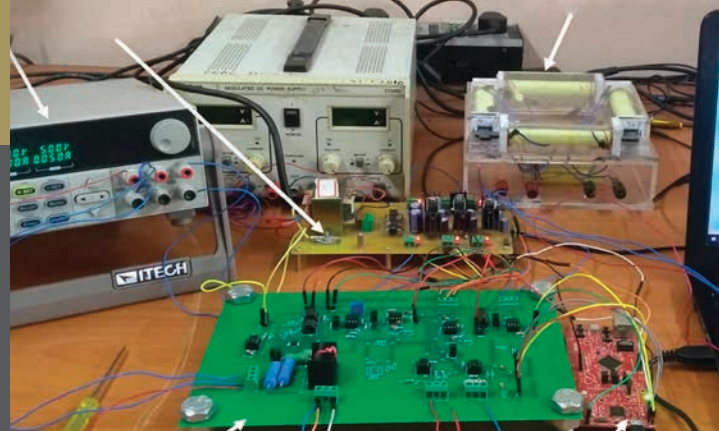# Novel Cost-Effective Magnetic Characterization Tool for Soft Magnetic Materials Used in Electrical Machines

Problem Statement: Soft magnetic materials used in electrical machines and equipment exhibit nonlinear and hysteretic behaviour during their magnetisation process. The loss behaviour of these materials depends on the excitation waveform, direction of magnetic excitation and other operating conditions. Commercial systems use expensive power amplifiers and data acquisition (DAQ) cards. Also, the standard Epstein bridge, which is popularly used to characterise soft magnetic laminations, requires higher voltages at higher frequencies. Thus, the researchers at IIT Bombay have attempted to design a flexible and cost-effective digital characterisation tool for measuring hysteresis characteristics and loss in the soft magnetic material. The voltage requirements at higher frequencies are reduced by designing a new Epstein bridge with smaller dimensions and a lesser number of turns.

Uniqueness of the Solution: Among the key novelties of the work is the design and fabrication of a low-cost amplifier circuit along with a small Epstein bridge, which can be used to measure losses for a frequency range of 200–500 Hz. In addition, a loss separation algorithm is implemented in the LabVIEW based characterisation tool for the first time. This feature is used to predict the losses beyond the frequency range of the setup. The proposed tool is also capable of characterising soft magnetic materials for arbitrary flux density waveforms with harmonics. The designed setup is cost-effective compared to the existing tools in the literature and commercial magnetic characterisation systems available in the market.

Current Status of Technology: Technology validated in the laboratory environment.

Societal Impact: The development of this tool indigenously would greatly aid in import substitution for niche applications.

Patent(s): Filed

Relevant Industries: Transformers, Electrical, Steel.

Faculty: Prof. S. V. Kulkarni, Electrical Engineering.