National University of Sciences and Technology (NUST)
School of Electrical Engineering and Computer Science

Topic: Motor Current Signature Analysis for Fault Detection in Induction Motors

Class:	BEE-15	**Section:**	B
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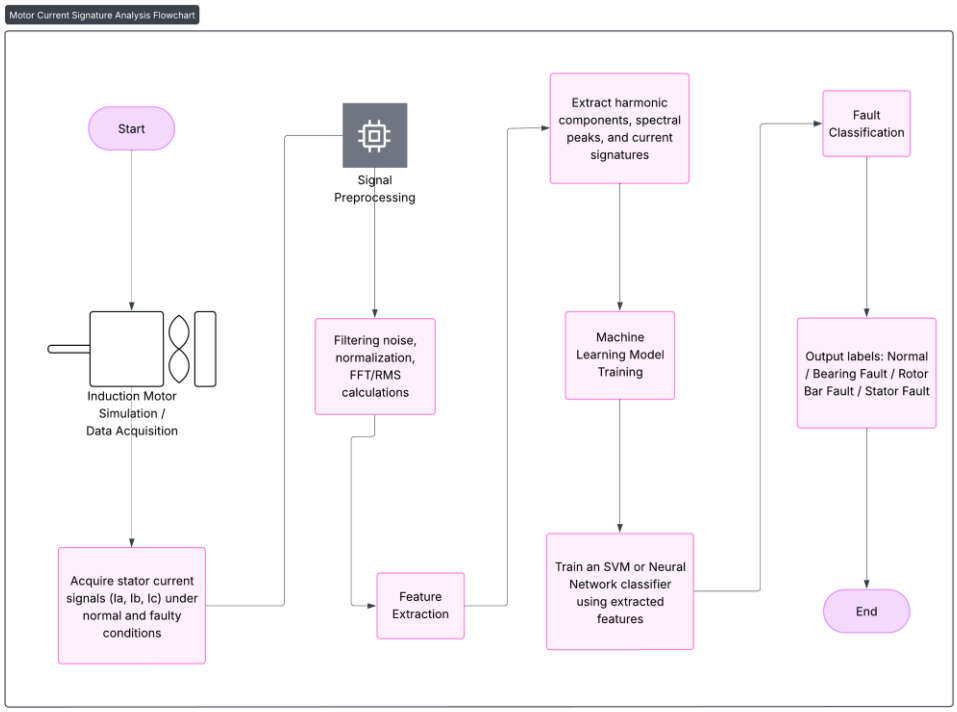
1. Aims and Objectives:

- To analyze the stator current signal of an induction motor for identifying abnormal operating conditions and faults.
- To extract key time-domain and frequency-domain features from the motor current waveform using Motor Current Signature Analysis (MCSA).
- To apply machine learning techniques for classifying normal and faulty conditions (such as bearing faults, broken rotor bars, and stator short-circuits).

2. Block Diagram/Flow Chart/Circuit diagram:



3. Expected Results/Outcomes

- Accurate detection and classification of induction motor faults through analysis of current signals.
- Identification of fault-specific frequency components using FFT and current signature analysis.
- Visualization of motor current waveform differences between normal and faulty operations.
- Performance evaluation using confusion matrix, accuracy, precision, and recall of the ML classifier.
- Demonstration of how MCSA combined with AI enables predictive maintenance in electrical machines.

4. References:

- P. Vas, Parameter Estimation, Condition Monitoring, and Diagnosis of Electrical Machines, Oxford University Press, 1993.
- M. Nandi, H.A. Toliyat, and X. Li, "Condition monitoring and fault diagnosis of electrical machines—A review," IEEE Transactions on Energy Conversion, vol. 20, no. 4, pp. 719–729, 2005.
- MATLAB Documentation – Signal Processing Toolbox and Machine Learning Toolbox, MathWorks, 2024.
- S. Ahmed et al., "Motor current signature analysis and machine learning for induction motor fault detection," IEEE Access, vol. 11, 2023.

5. Sub-domain:

- Electrical Machine Control / Fault Diagnosis using AI