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Fault Detection and Diagnosis in Electric Drive Systems

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INTRODUCTION & AIM

•Electric machines are key components in industrial operations due to their robustness, cost-effectiveness, and ease of maintenance.

•Inverter-fed asynchronous motors are widely used, but their reliability can be compromised by faults in the motor, converter, sensors, or mechanical parts.

•Ensuring **service continuity** and **fault tolerance** is essential for industrial efficiency.

•**Aim**: Develop diagnostic and monitoring strategies to detect faults under variable-speed operation and improve system reliability.

METHOD

•System Setup: Asynchronous motor coupled to an inverter, controlled by field-oriented vector control with speed regulation.

•Fault Characterization: Based on both simulations and experimental measurements.

•Diagnostic Approaches:

•Signal Processing Approach: Constant position increment sampling applied to overcome variable-speed challenges.

RESULTS & DISCUSSION

•The signal processing approach proved robust for detecting faults under varying speed conditions.

•The observer-based method enabled reliable and accurate fault diagnosis in real time.

•Experimental results validated the effectiveness of both approaches, showing good agreement with simulations.

•Developed tools demonstrate the feasibility of a comprehensive monitoring system, capable of continuously assessing component health and detecting malfunctions.

•These strategies enhance reliability, minimize downtime, and support predictive maintenance in industrial applications.

CONCLUSION

•A dual diagnostic strategy combining signal processing and analytical redundancy was successfully developed and validated.

•The proposed monitoring system enhances fault detection, system reliability, and reduces unexpected downtime.

•Results demonstrate the feasibility of predictive maintenance in inverter-fed asynchronous drives.

•This work contributes to fault-tolerant and efficient industrial processes.

FUTURE WORK / REFERENCES

FUTURE WORK:

•Integrate the monitoring system with Industrial IoT platforms for real-time fault diagnosis.

•Investigate machine learning and AI-based techniques to improve prediction accuracy.

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