A METHOD FOR OPERATING AN INDUCTION MACHINE WITH REDUCED TORQUE RIPPLE FOR MEDIUM VOLTAGE APPLICATIONS

IITM Technology Available for Licensing

Problem Statement

- Lack of controllable turnoff capability in SCR-based drives limits their compatibility with induction motors in medium voltage applications, leading to commutation failures due to lagging power factor.
- **Attempts to compensate for lagging power factor by supplying additional reactive power introduce challenges**, including the need for a supplementary voltage source inverter rated for medium voltage levels.
- There is a need for a technique to mitigate torque ripple in **induction machines specifically tailored for medium voltage applications.**

Images

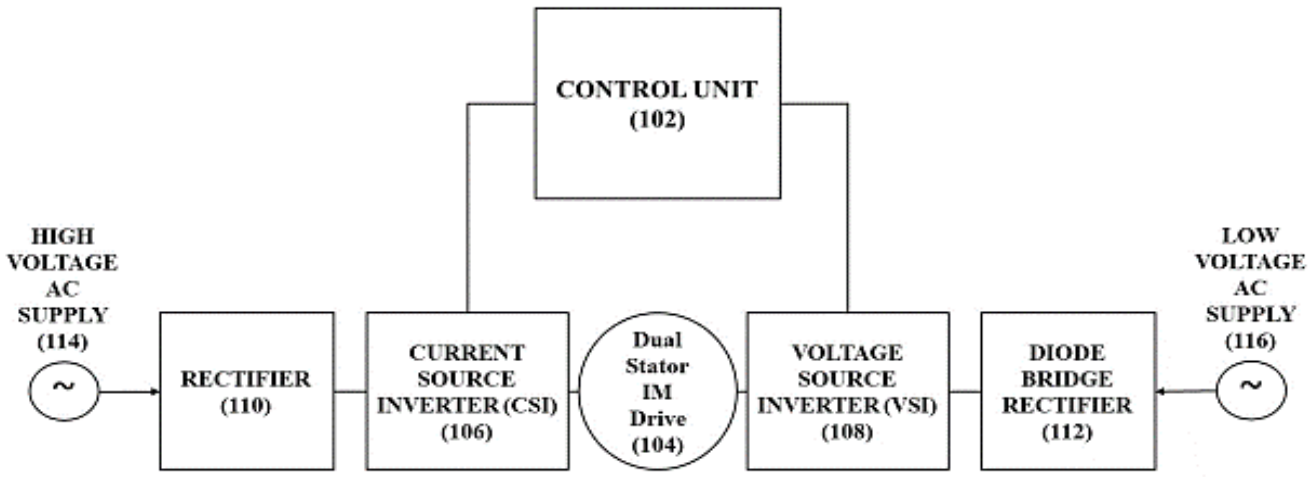

FIG. 1. Block diagram of the CSI fed dual-stator induction motor drive.

Intellectual Property

- IITM IDF Ref. **1969**
- **IN 498787 - Patent Granted**

TRL (Technology Readiness Level)

TRL - 4: Technology validated in lab scale.

Research Lab

Prof. Kamalesh Hatua,
Dept. of Electrical Engineering

Technology Category/ Market

Power Electronics and Semiconductor Devices.
Applications- Renewable Energy Systems, Electric Vehicles (EVs)
Industry - Power Electronics & Automotive

Market - Global power converter market was valued at $20.9 billion in 2022 and is estimated to reach $44.6 billion by 2032, exhibiting a CAGR of 7.8%.

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Technology

1. The disclosed method and system involve operating an induction machine with both a current source inverter (CSI) and a voltage source inverter (VSI), utilizing the CSI for supplying active and reactive power while the VSI is responsible for generating a range of voltage vectors.

2. The control unit estimates current unit vectors for the CSI based on flux and speed controllers, generating firing pulses to ensure proper operation of the CSI, particularly during lagging power factor conditions. Additionally, it identifies turn-off instants for the conducting thyristors in the CSI and determines commutation voltages to facilitate smooth transitions.

3. By selecting appropriate voltage vectors from the VSI and applying them to the auxiliary LV winding of the induction machine, the system minimizes voltage error vectors and induces commutation voltages in the CSI, effectively managing the operation of the thyristors and ensuring stable performance of the induction machine.

Key Features / Value Proposition

1. Enhanced Efficiency:	Integrating both current source inverter (CSI) and voltage source inverter (VSI) optimizes efficiency and reliability in induction machine operation.
2. Improved Power Factor Correction	The system dynamically adjusts power factor, ensuring efficient power utilization even under varying load conditions.
3. Seamless Commutation Management:	By accurately identifying turn-off instants and applying appropriate commutation voltages, the system ensures smooth transitions within the current source inverter.
4. Precise Voltage Vector Selection	Selection of voltage vectors from the VSI minimizes error vectors, enhancing overall system performance and stability.
5. Flexibility in High Voltage Applications	Suitable for medium voltage applications, the system offers flexibility and scalability for various industrial setups.
6. Cost-effective Solution	Combining the advantages of both CSI and VSI, the system provides a cost-effective solution with improved performance for high-power induction machine drives.

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