

### Methods to Mitigate the Effect of Power Quality Disturbances on the DC Bus Capacitor

IITM Technology Available for Licensing

#### Problem Statement

- Due to the **increased abnormality in supply voltage**, **Adjustable Speed Drive (ASD)** connected to grid are required to be protected from adverse effects of poor power quality.
- Based on the field **Power Quality (PQ)** data study, distortion in the supply voltage is found to be the dominant disturbance followed by unbalance. These **mainly affect the DC bus capacitor** and may lead to a failure. But, there is no solution to **increase the ASD immunity** under distorted and unbalanced grid conditions.

In order to **save the ASD** from such grid disturbances, a **cost-effective auxiliary circuit** is introduced in this patent that will make **ASD immune to supply voltage distortion and unbalance**.

#### Technology Category/ Market

**Energy, Energy Storage & Renewable Energy; Electronics & Circuits**

**Industry:** Power Electronics Industry, Energy Infrastructure, Clean Energy, Water Treatment

**Applications:** Used in any AC to DC converter feeding any kind of load. Power quality improvement of ASD, immunity of AC-DC converters.

**Market:** The global variable frequency drive market size was valued at **\$25.92 B** in 2022 and is expected to expand at a **CAGR of 5.6% from 2023 to 2030**.

#### Intellectual Property

**IITM IDF Ref: 2255;**

**Patent No.: 419671 (Granted)**

#### Key Features / Value Proposition

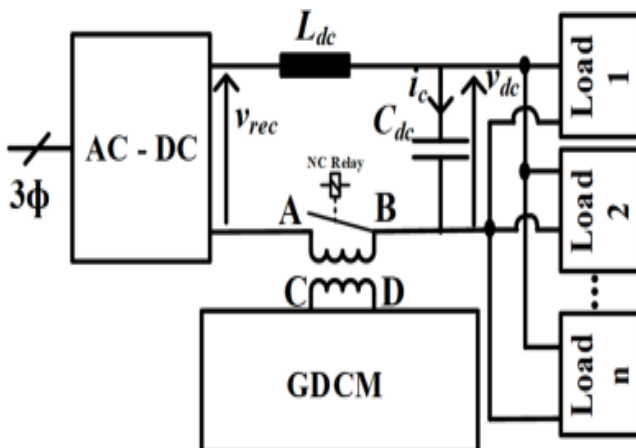
- While reducing **stress on the capacitor**, this auxiliary circuit also reduces **the harmonics** in source current.
- The proposed auxiliary circuit is a **retrofit** to existing ASD & is used in case of **poor quality voltage supply**.
- Used to improve **immunity & harmonics** of a diode bridge AC to DC converter **feeding any type of load**.
- They are suitable for **diode bridge front-end adjustable speed drives**.
- The capacitor current is **free** from the **frequency components** produced by **power quality disturbances** after rectification.
- The **stress** on the **DC bus capacitor** is reduced which results in **better thermal performance** in the event of grid disturbances.

#### Research Lab

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#### Images



**Fig. 1** illustrates the GDCM in an AC to DC converter feeding multiple loads with a common DC bus.

#### Technology

- The present patent discloses a **Grid Disturbance Compensation Module (GDCM)**, operated based on the stress level of the DC bus capacitor.
- The GDCM connected between the **rectifier & the DC Bus capacitor** in a Main conversion unit.
- The GDCM comprises an **AC source**, a converter including a first rectification unit, a filter connected to the output terminal of the first rectification unit and including an inductor **L<sub>dc</sub>**, a DC bus capacitor (**C<sub>dc</sub>**) and one or more loads.
- Further the GDCM module comprises a **compensator DC bus** including **one or more capacitors and a DC to AC converter** having **one or more controllable switches** connected to the compensator DC bus.
- Said compensator DC bus and the DC to AC Converter are interfaced to a DC side of the Main Conversion Unit.
- The DC to AC converter is a **H-bridge having controllable semiconductor switches**.
- The GDCM is interfaced at an output terminal of the first rectification unit in the **main conversion unit** through a step-down transformer and a relay.
- The GDCM is designed to inject a voltage in the DC side of the Main Conversion Unit.
- Thereby, the GDCM is configured to **reduce the effect of power quality disturbances** on the DC bus capacitors.
- **Fig. 1** illustrates the GDCM in an AC to DC converter feeding multiple loads with a common DC bus.

#### TRL (Technology Readiness Level)

TRL- 3/4 Proof of concept ready Stage

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