Retraction

Retraction: Inductive Load power factor Correction using Capacitor Bank (J. Phys.: Conf. Ser. 1916 012140)

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This article (and all articles in the proceedings volume relating to the same conference) has been retracted by IOP Publishing following an extensive investigation in line with the COPE guidelines. This investigation has uncovered evidence of systematic manipulation of the publication process and considerable citation manipulation.

IOP Publishing respectfully requests that readers consider all work within this volume potentially unreliable, as the volume has not been through a credible peer review process.

IOP Publishing regrets that our usual quality checks did not identify these issues before publication, and have since put additional measures in place to try to prevent these issues from reoccurring. IOP Publishing wishes to credit anonymous whistleblowers and the Problematic Paper Screener [1] for bringing some of the above issues to our attention, prompting us to investigate further.

[1] Cabanac G, Labbé C and Magazinov A 2021 arXiv:2107.06751v1

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Inductive Load power factor Correction using Capacitor Bank

M Shanmugapriya¹, Aarim C Sijini¹, Srinivas V T², Karthick M² and Pavan S²
¹Assistant Professor, Department of Electrical and Electronics Engineering, Vel Tech High Tech Dr Rangarajan Dr Sakunthala Engineering College, Chennai
²U G Scholar, Department of Electrical and Electronics Engineering, Vel Tech High Tech Dr Rangarajan Dr Sakunthala Engineering College, Chennai
shannmugapriya.m@velhightech.com, aarimsijini@velhightech.com, srinivastv09@gmail.com, karthik20166@gmail.com and michealpavan1122000@gmail.com

Abstract. At this time, efficient power generation is critical because power leakage is a global problem. The power factor of a machine tests its power efficiency and is a significant factor in improving supply quality. A low power factor caused by high load of utilises of inductive load is often ignored in the majority of control systems. A power factor correction unit will enable the system's power factor to be restored to near unity for cost-effective operation. Reduced power system losses, enhanced load carrying capabilities, improved voltages, and other benefits of power factor correction are only a few of the benefits. The aim of this program is to develop an Power Factor Correction Unit which can monitor a system's energy consumption and increase its power factor. For accurate power measurement, an open source energy monitoring library was used in the design. The energy monitor unit measures the reactive strength absorbed by a load network and uses capacitor bank to compensate for the lagging power factor.

1. Introduction

An element of energy is the measure of the actual energy that is perceived by the visible energy load flowing in the region. [1] Basically a measure of how a current upload is converted into an active product. The smaller the power factor of the system, the less effective it is economically. A substantial shift between the electric current and current at the estimated value, high frequency object, or perhaps a twisted square wave all examples of high harmonic objects can create all low power [2].

Induction motors, electric transformers and inlet are examples of energy-intensive loads that allow the current to lag behind power. Adjusting the power factor can increase the weak energy element caused by non-moving loads, but the negative energy factor created by the twisted current form requires mechanical adjustment or the addition of harmonic filters [3]. Since power inputs have a low power factor, they should be given operational power to reduce the increasing power consumption of the machine.

Active energy (KW) is required to perform physical activity, and to strengthen the magnetic field KVAR (active force) is required. This KVAR is required for equipment to operate, but it is difficult to supply leading to phase loss and current (current lags voltage. of low power will lead [4].
The loss of the negative energy element is caused by the current flowing in the grid, which can be avoided using the PFC. The method of charging the remaining current by the leading current by connecting the capacitance to the supply is known as the adjustment factor. Capacitors in high-power repair systems draw current that is more than electrical, leading to a leading power factor. Attachments are large enough to get the power element as close to unity as possible [5]. Capacitors may provide 100% of the required operating power, but in practice, bringing the energy factor closer to unity can cause harmonic interference. In a wired region the connected capacitor has a low PF, the lag value in the circuit decreases evenly.

To reduce the magnetic field as much as possible and to reduce the loss of the distribution system, the power factor correction is used. It has various benefits for industrial power consumers, including low electricity costs due to lack of effective electricity prices, reduced delays, and the provision of additional KVA from the current source [6]. As a result, it increases energy efficiency.

2. Existing system

There are several power factor correction treatment aims in today's world.

2.1. Synchronised Condenser

It's a combined motor, which spins even though no force is added. Capacitive thing occurs when an asynchronous motor is overly ecstatic. By regulating the field, the field optimise power factor can be updated indefinitely. It decreases the quantity of measures necessary to repair PF and is unaffected by machine harmonics. It is, however, pricey to build and maintain.

2.2. Bank of Static Capacitors

Since capacitors transfer current instead of voltage, they induce leading power factor. So, to fix the low PF, it is a simple approach that is widely used around the world. Despite certain drawbacks such as the not being able to absorb harmonics and the lack of correction without steps, it is a common option for PFC due to its low cost installation and maintenance.

2.3. Other Techniques

There are a few more complex techniques for Power factor improvement that have been developed but are not widely used for economic reasons, and some of these methods are still being researched. Other techniques under investigation include phase advancers, three-phase buck-boost correction circuits, and monitoring methods. Since it is more economical to build, our designed device is based on the use of capacitors to correct the power factor. The microcontroller will decide the PF, and capacitors will be connected to the device. Automatic capacitor combination switching guarantees the desired amount of PF correction while preventing over-correction.

3. Proposed System

In our model we take 230V, 50Hz as a power source and connect to a power transformer to step back the voltage level to 12volts. The converts the 12V into different DC sample voltages. The sample voltages is processed through the voltage sensor circuit is used to process the data for MATLAB input. A current transformer extracts a sample of the latest signal from the mains supply, which is then analysed by means of a current-sensing circuit for another MATLAB input. The MATLAB software performs harmonic flux calculation and show the capacitor value based on the capacitor value and tuning the capacitor and increase the power factor as shown in Figure 1.
4. Methodology of Concept
The entire system contains of five designs. This modules run together to identify the capacitance to rectify the power factor. These designs are follows below:

- Power Input
- Voltage sensor circuit
- Current circuit sensor
- System loading
- Capacitor bank

4.1. Input Power supply
The input AC mains will have 230V 50Hz. However, in order to operate the modules, DC power is required. The 230V supply is step back to 12V using a potential converter. After that, by using filtering capacitor and bridge rectifier DC signals are obtained from AC signals. Voltage regulator ICs are used to produce the final reliable DC outputs.

4.2. Voltage sensor circuit
The 230V AC is step back to 12volts Alternating Current from the mains. A voltage splitter circuit separates the 12 volts in a 1:10 ratio, yielding a 1.2 volt sinusoidal signal. The sinusoidal signal is given a 2.5v DC offset. Which results, the entire sinusoid signal can be seen in the positive limit (0-5v), and the SIGVIEW can read it from its analogue data. The voltage sensor system's circuit diagram as shown in Figure 2.
4.3. Current sensor circuit
A new transformer retrieves the current signal flowing through the mains. A resistor issue converts the current signal into a voltage structure which reflects the current sinusoid's possessions. The sinusoidal signal is given a 2.5V ADC offset voltage, which raises the reference point and allows the entire sinusoid to be study in analogue mode under the parameters of its activity (0-5V).

4.4. System load
The system is made up of a variety of separate loads getting inductive properties and using a lot of electricity. Due to a lagging power factor, there is a lack of power. The network as a whole imitates a strongly inductive load running at a low current density a factor of strength.

4.5. Capacitor bank
A capacitor bank is a grouping of capacitors of various sizes. A spectrum of capacitance is provided by combining separate capacitors in series and parallel to compensate for low power factor. The size of capacitors is dictated by the load network's necessary KVAR demand.

The accompanying diagram depicts the project's fully operational architecture.

5. Technical design
The system's technical architecture can be broken down into four steps: SIGVIEW Library, MATLAB Calibration, KVAR measurement, and capacitor switching.

5.1. SIGVIEW Library
SIGVIEW is an open source library that was created for the purpose of energy monitoring. The SIGVIEW library can read and measure analogue voltage and current signals, as well as mains voltage, current, KW, KVAR, KVA, and power factor. The library's construction methods are supported by the SIGVIEW developers and can be used to retrieve the above-mentioned necessary power parameters.

5.2. MATLAB Calibration
Based on the signals obtained from the SIGIEW Library the voltage and current signal are placed in the MATLAB software to identify the original signal of the power supply based on that the library show the required capacitor value as shown in Figure 3.

![Figure 3. Schematic diagram of Data Acquisition system](image_url)

5.3. Capacitor Switching
The microcontroller determines the necessary reactive power demand and compared to organic the capacitors in the capacitor bank to the target output. This swapping operation is carried out with the aid of a multiple channel relay module as shown in Figure 4.

![Figure 4. circuit connection of Data Acquisition system](image)

To demonstrate the power factor correction and energy monitoring system's operation, a load network of strongly inductive loads was installed. Different power factors were applied to the device by linking the loads in a combinational fashion. The system load contains a series of inductor with a significant value of inductance in series with a resistor mix. A resistance is reduced while the inductance is maintained, the relation of inductance to refractory part increases, and the power factor decreases. As the result, the system's power factor decreased.

The device can identify and calculate a load network's exact power factor. The pre-programmed MATLAB software will figure out how much VAR demand is required to raise the power factor.

Data acquisition circuit diagram Dependent on the energy requirement, the software show the capacitor value and the data collected by the device is seen below in table 1.

**Table 1.** Data collected by Data acquisition system shows before correction and After correction

| Before correction | After correction |
|-------------------|------------------|
| P.F   | I(A)  | A.P(VA) | P.F   | I(A)  | A.P(VA) |
| 0.85  | 0.77  | 171     | 0.96  | 0.70  | 156     |
| 0.72  | 1.02  | 229     | 0.96  | 0.79  | 177     |
| 0.60  | 1.22  | 271     | 0.96  | 0.80  | 178     |
| 0.50  | 1.35  | 301     | 0.96  | 0.76  | 172     |

6. **System Flowchart:**
The systematic flowchart of the system is given as shown in Figure 5 and Figure 6. Figure 7 shows the result.

![Flowchart of the inductive load power factor correction](image)

**Figure 5.** Flowchart of the inductive load power factor correction

7. Result Analysis

![Original signal with using capacitor](image)

**Figure 7.** Original signal with using capacitor

8. Conclusion

To boost the system's reliability and performance, capacitor bank method can be used in industries, industrial lines, and power delivery networks. It is important to exercise caution to ensure that the capacitors are not subjected to abrupt on-off-on conditions or overcorrection, as this will greatly reduce the capacitor bank's lifetime. The power factor correction device helps to mitigate electric bills by preventing high current drain from the grid. Reduced energy demand reduces greenhouse gas pollution and fossil fuel depletion at power plants, which is good for the atmosphere.

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