International Journal of Electrical and Electronics Engineers
Volume 17, Issue No. 01, Jan-June 2025
ISSN (O) 2321-2055
ISSN (P) 2321-2045

AUTOMATIC VOLTAGE STABILIZER BY USING PERMANENT MAGNET DC MOTOR

Assistant Prof. M. S. Bijali, Mr. Muaajam Aslam Makandar,
Mr. Nadim Gous Shaikh, Ms. Sakshi Hanmant Khot,
Ms. Pranoti Bajirao Mali

Department of Electrical Engineering, D.Y. Patil Technical Campus Talsande, Maharashtra

ABSTRACT

An Automatic Voltage Stabilizer (AVS) system plays a critical role in maintaining the voltage profile of a power system within acceptable limits while minimizing operational costs by coordinating the regulation of controllable components. Typically, the parameters involved in the optimization problem are considered certain and constant during decision-making processes. However, with increasing shares of wind power, the inherent variability in wind generation introduces uncertainty into the system, which may lead to infeasible AVS solutions. To address this challenge, this paper proposes a novel voltage control approach that explicitly accounts for voltage uncertainty stemming from fluctuations in wind power production. The proposed method enhances the performance and robustness of a scenario-based approach by estimating the potential voltage variations caused by fluctuating wind power. Furthermore, it introduces a voltage margin designed to protect the decision-making process from uncertainty in each scenario. The effectiveness of the proposed approach is demonstrated using the IEEE 39-bus model. Additionally, a Monte Carlo simulation is employed to verify and validate the results.

Keywords : Dimmer, Step-down transformer, Comparator, Transistor, Limit Switch, PMDC motor, MCB,

INTRODUCTION

When we got to know the survey of all electrical equipment and electrical fitting machineries then we analyzed that since last 2-3 years they have been lost their many of sensitive equipment and they faced huge of losses in terms of money and production rate. Then we actually inspected all earthing points and earthing rods to detect the actual faults but we came to know that there was no any earth fault in system.

Therefore, we inspected by our second stage of inspecting all shortages, over-voltage under-voltage fault detection process. Then we came to know that their was a serio us concern of voltage fluctuations. So we designed a single phase voltage controller device for purpose of protection of single phase sensitive devices.

A voltage controller is a device that continuously monitors the output voltage and regulates variations in the input voltage through the operation of a motor. This motor adjusts the output voltage on a variable transformer (variac), allowing for effective voltage regulation. The voltage controller is one of the most cost-effective power-conditioning solutions available, offering reasonably good voltage regulation in environments where voltage fluctuations are not significant.

However, its use is not recommended in areas outside large cities, where, in addition to considerable voltage fluctuations, the power supply may be subject to frequency drifts, failures, noise, and voltage spikes. In such cases, a voltage controller remains the most effective solution for managing erratic supply voltage conditions. This type of controller is compatible with all types of single-phase loads, including inductive, resistive, and capacitive loads. In contrast, other voltage stabilizers, such as Constant Voltage Transformers (CVTs) or Static Voltage Stabilizers, are not suitable for such applications due to their limitation Objective :

- **Protects equipment**
  AVS prevent equipment damage from voltage spikes, surges, and generator overload
- **Improves efficiency**
  AVS help equipment operate in the best conditions, which improves efficiency and reduces energy waste
- **Extends equipment life**
  AVS help equipment maintain a stable working state, which extends its service life
- **Applications**
  Air conditioning, Water pumps, Lighting, Pharmaceutical units, Hospitals, Footwear and leather units, Nursing homes, Cold storage, Rubber industries, and Tea estates.

CONCEPT

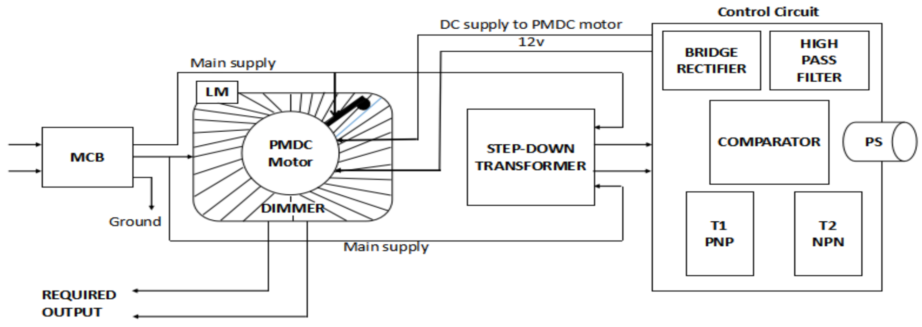
An Automatic Voltage Stabilizer (AVS) is designed to regulate voltage by converting fluctuating input voltage into a stable, constant output voltage. Voltage fluctuations typically occur due to variations in the load on the supply system, and such fluctuations can cause significant damage to power system equipment. To mitigate these variations, voltage control equipment is strategically installed at key locations within the power system, such as near transformers, generators, and feeders. In many cases, voltage regulators are deployed at multiple points across the system to effectively manage voltage deviations. In DC supply systems, voltage regulation can be achieved by using over-compounded generators, particularly when the feeders are of equal length. However, when feeders of different lengths are involved, voltage at the end of each feeder is maintained at a constant level using feeder boosters. In AC systems, voltage control is achieved through a variety of methods, including booster transformers, induction regulators, and shunt condensers, each offering distinct advantages depending on the system configuration.

PROJECT MODEL



International Journal of Electrical and Electronics Engineers
Volume 17, Issue No. 01, Jan-June 2025
ISSN (O) 2321-2055
ISSN (P) 2321-2045

Circuit Diagram



WORKING

The AC generator's output voltage is regulated using error detection. First, a potential transformer (PT) senses the high output voltage and steps it down. This lower voltage is then rectified and filtered to create a smooth DC signal. The rectified DC voltage is compared to a reference voltage, and their difference is the error voltage. An amplifier then amplifies this error voltage, and the amplified signal controls the main or pilot exciter. Based on this error signal, the excitation system adjusts the generator's field strength through buck or boost action, thereby regulating the excitation current to maintain the desired output voltage. Consequently, the exciter output control directly influences the main alternator's terminal voltage, ensuring its stability despite load changes or fluctuations.

ADVANTAGES

- **Protects devices**: AVS protect devices from voltage spikes and drops, which can damage them.
- **Improves performance**: AVS provide a consistent voltage, which allows devices to operate more efficiently.
- **Extends equipment lifespan:** AVS reduce wear and tear on equipment, which can extend its lifespan.
- **Supports generators:** AVS help generators operate properly by regulating output voltage and limiting voltage sag.
- **Stabilizes power supply**: AVS stabilizes the power supply voltage that fluctuates, ensuring it meets the requirements of electrical equipment.
- **Tolerates system faults:** Mechanical AVS can tolerate system faults, overload, power factor, and frequency deviations.

FEATURES

- **Voltage stabilization:** AVS maintain a constant voltage level by adjusting the voltage when it fluctuates.
- **Surge protection:** AVS protect against electrical surges, spikes, and generator overload.
- **Load division:**AVS can distribute the reactive load among generators operating in parallel
- **Fault detection:** AVS can detect faults like over-voltage, under-voltage, and over-temperature.
- **Load change response:** AVS quickly adjust the excitation system to keep the voltage stable when there are sudden load changes.
- **Over-voltage reduction:** AVS reduce over voltages caused by a sudden loss of load.

- **Automatic bypass:** Some AVS can switch into bypass mode when faults are detected.
- **Energy efficiency:** AVS can help save energy.
- **Response time:** AVS have a response time to voltage fluctuations.
- **Load capacity:** AVS have a load capacity and rating.

FUTURE SCOPE

- **Hybrid algorithms:**
  Combining algorithms like simulated annealing and manta ray foraging optimization can improve the speed of convergence and the quality of the step response
- **PID controllers:**
  These controllers are widely used because they are simple and can improve the system's response to harmful changes
- **Model reference adaptive control:**
  This method uses a fractional order and a genetic algorithm for optimization
- **Neural network predictive controllers:**
  These controllers can be optimized using an imperialist competitive algorithm

CONCLUSION

Hence, through this project, we can continuously monitor the output voltage and control variations in the input voltage by using motor movements.Due to this Automatic Voltage Controller many of sensitive equipment get protected like Sensors, PH meters, small size induction motor, testing lab equipment, lightning load, etc. This project act as Power saving unit at Voltage in between 230 to 270. It helps in power saving at running condition thus it reduces total Electricity tariff.

PROJECT OVERVIEW

The Automatic Voltage Stabilizer (AV**S**) plays a pivotal role in maintaining the stability and efficiency of power generation systems. It primarily functions to regulate the system's voltage, ensuring that the operation of the machine remains close to steady-state stability. This regulation is crucial for optimal performance, as it helps mitigate fluctuations that may arise under varying load conditions.

In systems where multiple alternators operate in parallel, the AVS ensures the proper division of the reactive load among the machines, promoting efficient load-sharing and preventing undue strain on any single alternator. Additionally, the AVS is essential in reducing over-voltages that may occur due to sudden load losses within the system. By adjusting the excitation, it effectively prevents voltage surges, which could otherwise lead to system instability.

Furthermore, during fault conditions, the AVS increases the system's excitation to ensure the maximum synchronizing power is available. This increased excitation helps maintain system stability during fault clearance, enabling the system to return to normal operation more quickly and efficiently once the fault is cleared.

KEY COMPONENT

- **Dimmer**: 1 KV Auto-transformer (Dimmer), Single Phase – 240V AC, Frequency: 50 – 60 Hz.1 Ph
- **Transformer:** Step-Down Multi Terminal

  Comparator: IC (LF-357) We Use LF-357 as Subtractor
- **Transistor (Motor Direction Control)**: BD243C Power Transistor (NPN), BD244B Power Transistor (PNP)
- **Preset:** helps in increasing and decreasing the resistance
- **Limit Switch**: Minimum 150V to Maximum 270V
- **PMDC Motor Drive:** DC - 12v

PROJECT BENEFITS

- **Cost-effective:** Combines three functionalities into one robot, reducing the need for multiple devices.
- **Sustainability:** Utilizes solar power, reducing energy costs and environmental impact.
- **Remote Accessibility**: Easy to monitor and control from anywhere using Iot technology.

Acknowledgment

I would like to express profound gratitude to my guide **Prof. Mr. M. S. Bijali**. On his invaluable support, encouragement, supervision and useful suggestions throughout this seminar work. His moral support and continuous guidance enabled me to complete my work successfully.

REFERENCES

[1] Joshi, Pallav, and Piyush Ghune. "Optimization of automatic voltage regulator by proportional integral derivative controller." International Journal of Research in Engineering and Technology, Volume: 05 Issue: 01 | Jan-2022.

[2] Alamgir, Mohammad Shah, and Sumit Dev. "Design and Implementation of an Automatic Voltage Regulator with Great Precision and Proper Hysteresis." International Journal of Advanced Science and Technology 75 (2021): 21-32.

[3] G NAVEEN KUMAR. " DESIGN OF A LOW COST SERVO CONTROLLED VOLTAGE STABILIZER ."International Journal of Research in Engineering & Technology (IMPACT: IJRET) Vol. 4, Issue3, Mar2020, 43-46.

[4] Sambhav Bansal, Shashi Kumar, Pankaj Kumar, Siyaram Bairwa, Pulkit Singh " Digital Servo Controlled Voltage Stabilizer-A Review." J. Adv. Res. Instru. Control Engi. 2020; 3(1).

[5] Larson, Tony R., et al. "Low dropout voltage regulator circuit including gate offset servo circuit powered by charge pump." U.S. Patent No. 6,188,212. 13 Feb. 2019.

[6] M. Htay and K. San Win, "Design and Construction of an Automatic Voltage Regulator for Diesel Engine Type Stand-alone Synchronous Generator", PP. 652-658.

[7] S. R. Patil and A. B. Jagadale. Multiprocessor communication system for three phase servo stabilizer, International Conference on Communication and Signal Processing, 2016, pp. 227-231.

[8] M. S. Alamgir and D. Sumit. Design and implementation of an automatic voltage regulator with a great precision and proper hysteresis, International Journal of Advanced Science and Technology, Vol. 75(1), pp. 21-32, 2015.

[9] Servo controlled voltage stabilizer introduction, amjadeee seminars blogspot, 1st December 2012.

[10] P. Eswaran, "Design of fuzzy logic controller for customized servo voltage stabilizer", 2nd International Conference on Electronic and Communication Systems, 26-27 February 2015, pages 103-106.

[11] Karimov R, Bobojanov M, Tairova N, Xolbutayeva X, Egamov A and Shamsiyeva N 2020 Non-contact controlled voltage stabilizer for power supply of household consumers IOP Conf Ser Mater Sci Eng 883

[12] Suresh P, Student P G and E R U M 2020 Static Voltage Stabilizer using IGBT and PWM with DSPIC33F Controllers 427–32