

Overvoltage Surge Protection System for Distributed Energy Resources

Current overvoltage protection solutions lack adequate semiconductor protection

The trend toward renewable energy is leading to an increasing population of distributed energy resources (DERs) (e.g., small-scale power generation sources located near user homes or businesses). They are connected to the power grid by an electronic power converter, and integrating DERs into the power grid poses a challenge to the power supply system's embedded passive power protection devices.

Existing protection devices lack proper surge current and voltage clamping capabilities against overvoltage episodes (e.g., lightning strikes and high/variable energy demands). Their limited capabilities make them unacceptable for vulnerable semiconductor devices.

There is a need for an interactive, controllable, overvoltage protection (OVP) solution for low- to medium-voltage applications that is capable of clamping power surges within a tight margin of the system's nominal voltage to adequately protect semiconductor devices in power converters.

Dynamic system provides rapid, high-voltage clamping for effective surge protection

iMOV offers a solution for enhanced surge protection by piggybacking on existing protection devices known as metal oxide varistors (MOVs) and expanding their action with power electronics to achieve better overvoltage clamping control.

MOVs are manufactured with materials that allow rapid device connection of 500 picoseconds, creating a fast response time. The system uses a combination of two series-connected MOVs with a power electronic switch, which allows controllable triggering of the OVP. This mechanism clamps surges within 20% of the system's nominal voltage to achieve the tight control necessary for effective semiconductor protection.

Shared voltage between the connected MOVs and the switch's parallel positioning to an auxiliary MOV create a potentially low-cost, scalable solution to OVP. This system also integrates microprocessors and sensors into its cloud-based architecture. With no expensive communications infrastructure, the system offers benefits that include lower system costs, cyberattack protection, and easier monitoring of iMOV system and power grid

health.

Summary Bullets

- iMOV is a dynamic system capable of achieving voltage surge clamping within 20% of the system's nominal voltage. This effectively provides protection for highly sensitive semiconductors present in DER-associated power converters.
- This system is built upon a metal oxide varistors (MOV) foundation, whose material composition inherently allows rapid device connection of 500 picoseconds for quicker response times.
- iMOV uses integrated microprocessors and sensors in a cloud-based architecture that provides protection against cyberattacks, reduces system cost, and allows system and power grid monitoring.

Solution Advantages

- **More effective:** This innovative system achieves power surge clamping within 20% of the system's nominal voltage for effective semiconductor protection.
- **Faster:** The material composition of MOVs inherently supports rapid device connection of 500 picoseconds for a quicker response than conventional overvoltage protection solutions.
- **Safer:** This system uses integrated microprocessors and sensors in a cloud-based architecture that makes it less vulnerable to cyberattacks.
- **Easy to use:** The cloud-based system allows easy monitoring of OVP device and power grid system status.
- **Less expensive:** This system leverages shared voltage to keep system costs low and uses a cloud-based infrastructure as a low-cost communication solution.
- **Scalable:** Shared voltage and parallel positioning of the system's power electronic switch allow scalability across the power grid.

Potential Commercial Applications

- OVP for low- to medium-voltage power applications
- DERs including:
 - Inverters
 - Electric vehicles and chargers
 - Rooftop solar photovoltaic panel systems
 - Battery storage
 - Natural gas turbines
 - Biomass generators

Inventors

- Dr. Deepakraj Divan
Professor- Georgia Tech School of Electrical and Computer Engineering
- Joseph Sune
Research Engineer II - Georgia Tech School of Electrical and Computer Engineering
- Kartavya Agarwal
Graduate Research Assistant - Georgia Tech School of Electrical and Computer Engineering

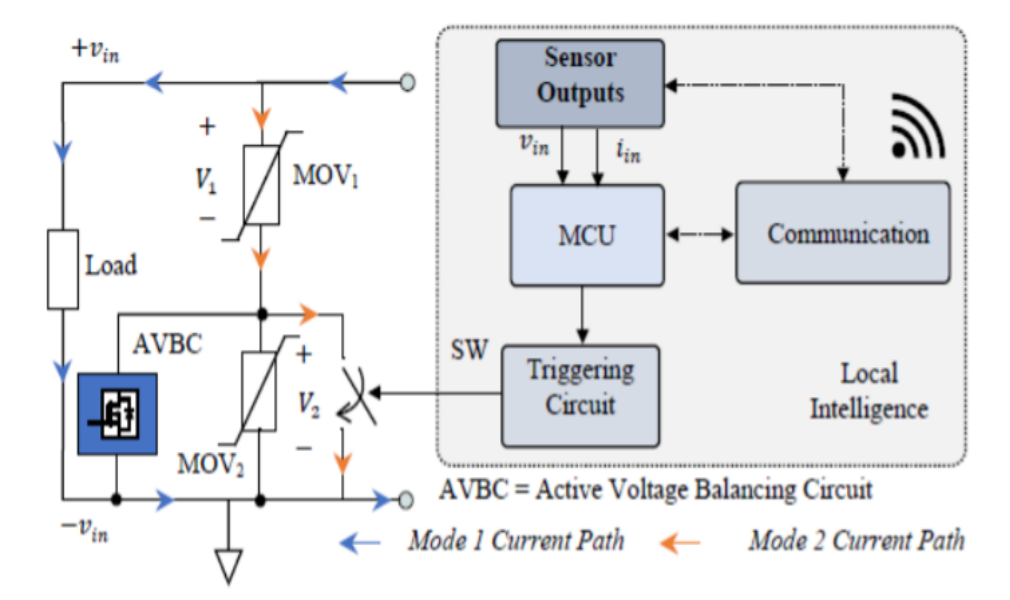
IP Status

<p>Patent application has been filed</p>: US63/488133

Publications

, -

Images



High-level electrical schematic of the system.

Visit the Technology here:

[Overvoltage Surge Protection System for Distributed Energy Resources](#)

<https://s3.sandbox.research.gatech.edu//print/pdf/node/4220>