

Robotics Based HVDC Transmission Line Harmonic Control and Power Theft Detection and Intimation using GSM Technology

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Abstract: The conventional HVDC systems are based on the line-commutated current source converter (LCC) and are line commutated. They suffer from the problem of commutation failures, and operation with weak ac systems is difficult. The HVDC converter control can destabilize torsional modes of nearby turbo generators. The VSC-based HVDC installations have several advantages compared to conventional HVDC, such as independent control of active and reactive power, dynamic voltage support at the converter bus, possibility to feed to weak ac systems or even passive loads, reversal of power without changing the polarity of dc voltage (advantageous in multi terminal dc systems), and no requirement of fast communication between the two converter stations. The amplitude and phase angle of the converter ac output voltage can be controlled simultaneously to achieve rapid and independent control of active and reactive power in all four quadrants. The control of active and reactive power is bidirectional and continuous across the operating range. For active power balance, one of the converters operates on dc voltage control and the other converter is on active power control. When dc line power is zero, the two converters can function as independent STATCOMs. Voltage-source converter high-voltage dc (VSC-HVDC) is becoming an attractive solution to deliver renewable energy to main grid. Harmonic resonances can impact the power quality (PQ) and the power transfer level. Harmonics are generated by switching sequences could be eliminated by ac filters.

Keywords: Extremely Low Frequency (ELF), HVDC, Line-Commutated Current Source Converter (LCC), Power Quality.

I. INTRODUCTION

A. HVDCs & HVAC

In general applications, HVDC can carry more power per conductor than AC, because for a given power rating, the constant voltage in a DC line is lower than the peak voltage in an AC line. This voltage determines the insulation thickness and conductor spacing. This reduces the cost of HVDC transmission lines as compared to AC transmission and allows transmission line corridors to carry a higher power density. A HVDC transmission line would not produce the same sort of extremely low frequency (ELF) electromagnetic field as would an equivalent AC line. While there has been some concern in the past regarding possible harmful effects of such fields, including the suspicion of increasing leukemia rates, the current scientific consensus does not consider ELF sources and their associated fields to be harmful. Deployment of HVDC equipment would not completely eliminate electric fields, as there would still be DC electric field gradients between the conductors and ground. Such fields are not associated with health effects. Because HVDC allows power transmission between nsynchronized AC systems, it can help increase system stability.

It does so by preventing cascading failures from propagating from one part of a wider power transmission grid to another, while still allowing power to be imported or exported in the event of smaller failures. This feature has

encouraged wider use of HVDC technology for its stability benefits alone. Power flow on an HVDC transmission line is set using the control systems of converter stations. Power flow does not depend on the operating mode of connected power systems. Thus, unlike HVAC ties, HVDC intersystem ties can be of arbitrarily low transfer capacity, eliminating the “weak tie problem,” and lines can be designed on the basis of optimal power flows. Similarly, the difficulties of synchronizing different operational control systems at different power systems are eliminated. Fast-acting emergency control systems on HVDC transmission lines can further increase the stability and reliability of the power system as a whole. Further, power flow regulation can be used for damping oscillations in power systems or in parallel HVAC lines. The advantages described above encourage the use of DC links for separating large power systems into several non synchronous parts.

B. Harmonic Control Techniques

In order to control the harmonic in this system there are many techniques can be used but most common technique is using PWM inverter. In which the triggering pulses are applied using the signals received from Robot.

C. Power Theft

Similar to harmonic control, the voltage and current values and various parameters are sampled and send it to nearby station. So that by knowing the changes in value due to theft

the system will get understand that there is theft. By using an alarm signal it is shown in Fig.1.

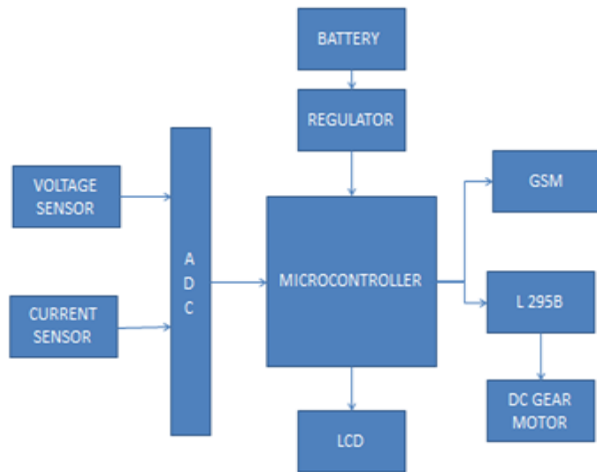


Fig.1. Block diagram of robot.

II. SENSORS

A. Current Sensors

The Allegro ACS75x family of current sensors provides economical and precise solutions for current sensing in industrial, automotive, commercial, and communications systems. The device package allows for easy implementation by the customer. Typical applications include motor control, load detection and management, power supplies, and over current fault protection. The device consists of a precision, low-offset linear Hall sensor circuit with a copper conduction path located near the die. Applied current flowing through this copper conduction path generates a magnetic field which is sensed by the integrated Hall IC and converted into a proportional voltage. Device accuracy is optimized through the close proximity of the magnetic signal to the Hall transducer. A precise, proportional voltage is provided by the low-offset, chopper stabilized Bi CMOS Hall IC, which is programmed for accuracy at the factory.

The output of the device has a positive slope ($>V_{CC} / 2$) when an increasing current flows through the primary copper conduction path (from terminal 4 to terminal 5), which is the path used for current sensing. The internal resistance of this conductive path is typically $100 \mu\Omega$, providing low power loss. The thickness of the copper conductor allows survival of the device at up to $5\times$ over current conditions. The terminals of the conductive path are electrically isolated from the sensor leads (pins 1 through 3). This allows the ACS75x family of sensors to be used in applications requiring electrical isolation without the use of opto-isolators or other costly isolation techniques. The device is fully calibrated prior to shipment from the factory. The ACS75x family is lead-free. All leads are coated with 100% matte tin, and there is no lead inside the package. The heavy gauge lead frame is made of oxygen-free copper.

B. Voltage Sensor

The Smart Q Voltage Sensors are used to measure the potential difference between the ends of an electrical component. This range of Voltage Sensors can be used to measure both DC and low-voltage AC circuits. The Smart Q Voltage Sensors are equipped with a micro controller that

greatly improves the sensor accuracy, precision and consistency of the readings. They are supplied calibrated and the stored calibration (in Volts) is automatically loaded when the Voltage Sensor is connected.

General Voltage Sensor:

Range: ± 20 V

Resolution: 10mV

Protected to a maximum voltage: ± 27 V

Impedance: 1M ohm

C. Features and Benefits

- Monolithic Hall IC for high reliability.
- Single +5 V supply.
- 3 kV RMS isolation voltage between terminals 4/5 and pins 1/2/3.
- 35 kHz bandwidth.
- Automotive temperature range.
- End-of-line factory-trimmed for gain and offset.
- Ultra-low power loss: $100 \mu\Omega$ internal conductor resistance.
- Ratio metric output from supply voltage.
- Extremely stable output offset voltage.
- Small package size, with easy mounting capability.
- Output proportional to ac and dc currents.

D. Applications

- Automotive systems
- Industrial systems
- Motor control
- Servo systems
- Power conversion
- Battery monitors

III. CONCLUSION

From the above data it is concluded that the transmission of power by means HVDC is more efficient and provides higher efficiency with reduced losses in transmission. Besides these minimization of losses power theft can also be detected in this method and by using GSM technology it is intimated to the nearby station to take necessary action.

Future Scope: In future, by using GPS technology it can also be able to give the exact location where the power theft occurs by using GSM with GPS technology via ROBOTIC action.

IV. REFERENCE

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