VOLTAGECONTROLLEDDSTATCOM FORPOWERQUALITY IMPROVEMENT

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ABSTRACT

In this project a new technique to generate reference voltage for a distribution static compensator (DSTATCOM) operating in voltage-control mode. The proposed scheme exhibitsseveral advantages compared to traditional voltage controlled DSTATCOM where the reference voltage is arbitrarily taken as 1.0 p.u. The proposed scheme ensures that unity powerfactor (UPF) is achieved at the load terminal during nominal operation, which is not possible in the traditional method. Also, the compensator injects lower currents and, therefore, reduceslosses in the feeder and voltage-source inverter. Further, a saving in the rating of DSTATCOMis achieved which increases its capacity to mitigate voltage sag. Nearly UPF is maintained, while regulating voltage. This paper proposes a new algorithm to generate reference voltage for stage at the load terminal, during load change. The statespace model of DSTATCOM is incorporated with the deadbeat predictive controller for fast load voltage regulation during voltage disturbances. With these features, this scheme allows DSTATCOM to tackle power- quality issues by providing power factor correction, harmonic elimination, load balancing, and voltage regulation n the load requirement. Simulation and experimental results are presented to demonstrate the efficiency of the proposed algorithm.

INTRODUCTION

Voltage-Controlled Distribution Static Compensator (VOLTAGECONTROLLEDDSTATCOM) is a type of power electronics-based device that is commonly used in power systems to improve power quality. It is a shunt-connected, static compensator that is capable of compensating reactive power and mitigating voltage fluctuations in the power system.

The primary function of a VOLTAGECONTROLLEDDSTATCOM is to maintain a constant voltage at the point of connection by injecting or absorbing reactive power as needed. It accomplishes this by controlling the voltage magnitude and phase angle of its output current to counteract any disturbances in the power system. This helps to improve the voltage profile, reduce voltage fluctuations, and enhance the stability of the power system.

VOLTAGECONTROLLEDDSTATCOM can be used to mitigate a range of power quality issues, including voltage sags, swells, flicker, harmonics, and unbalance. It is a versatile device that can be used in a wide range of applications, including renewable energy systems, industrial power systems, and distribution networks.

In summary, VOLTAGECONTROLLEDDSTATCOM is a highly effective device for improving power quality in power systems. Its ability to inject or absorb reactive power in response to disturbances helps to maintain a stable voltage profile and ensure reliable power delivery.

LITERATURE SURVEY

Unified approach for mitigating voltage sag and voltage flicker using DSTATCOM A. Elnady, Electrical and Computer Engineering detail - University of Sharjah and M. Salama, Professor of Architecture and Head of the Department of Architecture at the University of Strathclyde Glasgow, UK. IEEE Trans. Power Del., vol. 20, no. 2, pt. 1, pp. 992–1000, Apr. 2005.

A fast-acting dc-link voltage controller for three-phase DSTATCOM to compensate ac and dc loads M.K. Mishra, Professor, Department of Electrical Engineering, Indian Institute of Technology, Madras and K. Karthikeyan Ph.D. degree in electrical engineering from the Indian Institute of Technology, Madras, Chennai, Senior Engineer with Converteam EDC Private Ltd., Chennai.

A novel method of load compensation under unbalanced and distorted voltages Mahesh K. Mishra Assistant Professor in the Electrical Engineering Department with the Indian Institute of Technology Madras, Chennai. Arindam Ghosh Professor of Power Systems with the Queensland University of Technology, Brisbane, Australia. Avinash JoshiProfessor of Electrical Engineering at the Indian Institute of Technology (IIT), Kanpur, India.Hiralal M. Suryawanshi Assistant Professor in the Department of Electrical Engineering,Visvesvaraya National Institute of Technology, Nagpur.

Load compensating DSTATCOM in weak ac systems Arindam Ghosh Professor of Electrical Engineering at the Indian Institute of Technology Kanpur. Gerard Ledwich Chair Professor in Electrical Asset Management at the Queensland University of Technology, Australia.

Voltage regulation with STATCOMs: Modeling, control and results Amit Jain Analog Power Design, Inc., Lakeville, MN Karan Joshi Clarkson University, Potsdam, NY. Aman Behal Assistant Professor with the Electrical and Computer Engineering Department, Clarkson University, Potsdam, NY. Ned Mohan Oscar A. Schott Professor of Power Electronics at the University of Minnesota, Minneapolis.

PROPOSED SYSTEM

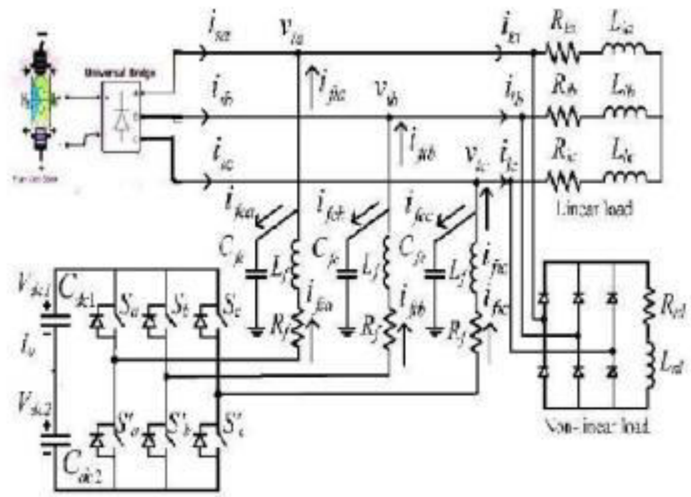


Fig.1: RES fed Proposed D-STATCOM compensated distribution system

Above figure shows the proposed fuel cell, universal bridge of three-level, neutral-pointclamped VSI topology. This structure allows independent control to each leg of the VSI. Figure shows the single-phase equivalent representation of Figure. Filter inductance and resistance are Lf and Rf, respectively. Shunt capacitor Cfc eliminates high-switching frequency components.

Using the proposed method, terminal voltages and source currents in phases a, b and care shown in Fig., respectively. It can be seen that the respective terminal voltages and source currents are in phase with each other, in addition to being balanced and sinusoidal. Therefore,UPF is achieved at the load terminal. For the considered system, waveforms of load reactive power (Qload), compensator reactive power (Qvsi), and reactive power at the PCC (Qpcc) in the traditional and proposed methods are given in respectively. In the traditional method, the compensator needs to overcome voltage drop across the feeder by supplying reactive power into the source. As reactive power is supplied by the compensator, this confirms that significant reactive current flows along the feeder in the traditional method. However, in the proposed method, UPF is achieved at the PCC by maintaining suitable voltage magnitude. Thus, the reactive power supplied by the compensator is the same as that of the load reactive power demand. Consequently, reactive power exchanged by the source at the PCC is zero. These waveforms, The source rms currents in phase-a for proposed method, respectively. Consequently, it reduces the ohmic losses in the feeder. The compensator rms currents in phase-a for the traditional and proposed methods, respectively.

SIMULATION RESULTS

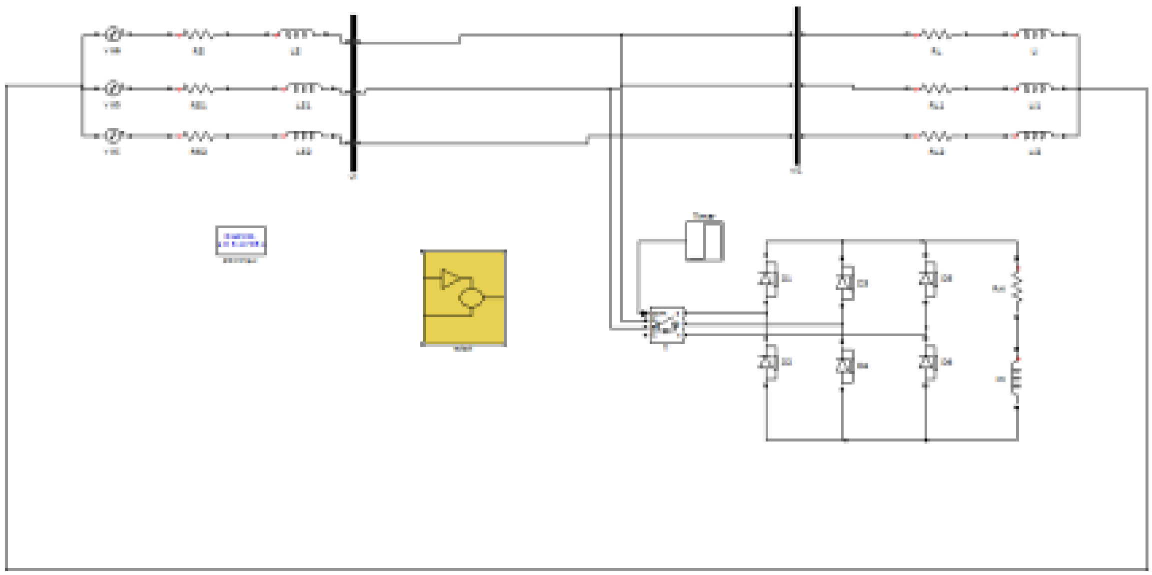
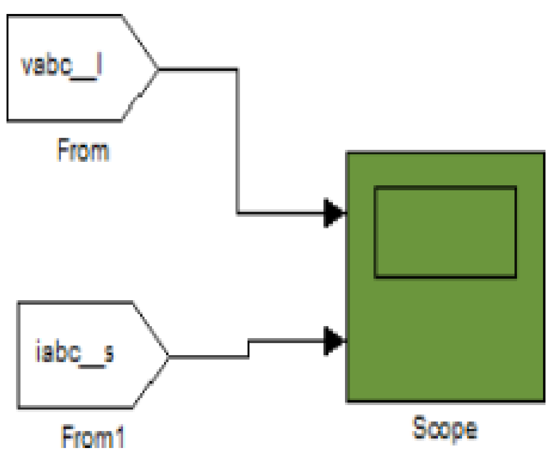
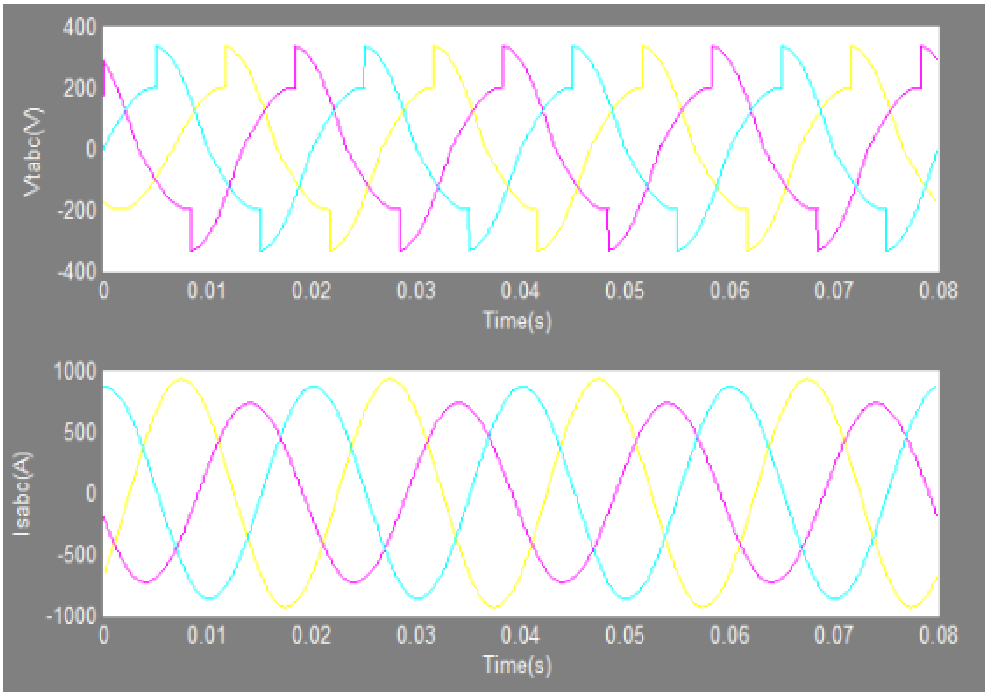


Fig.2: The Simulation circuit for before compensation



before compensation (Terminal Voltages and Source Currents)



The simulation wave form of terminal voltages and source currents

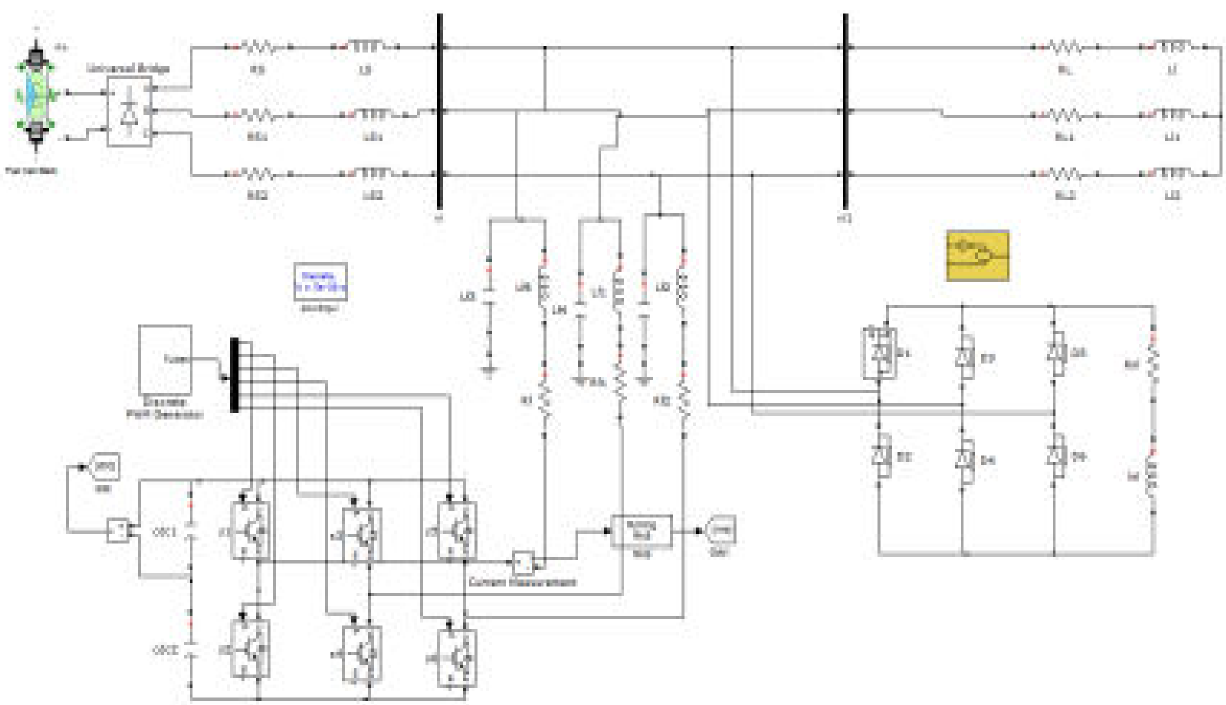
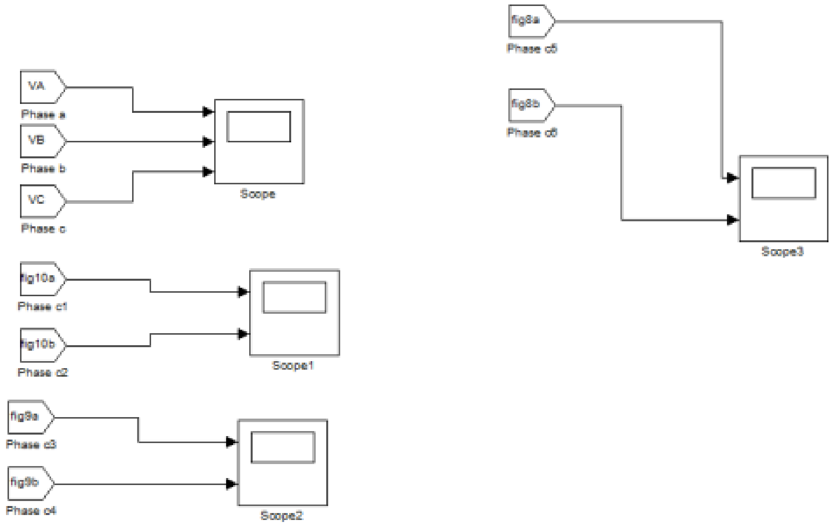
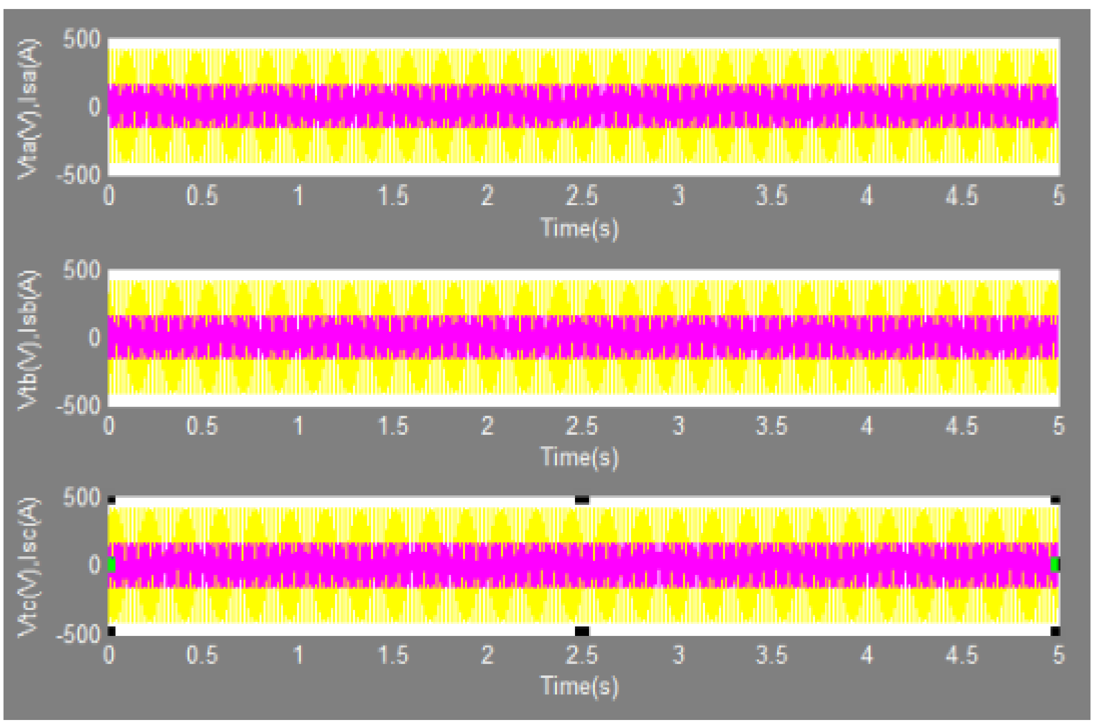


Fig.3: The Simulation circuit for RES fed system

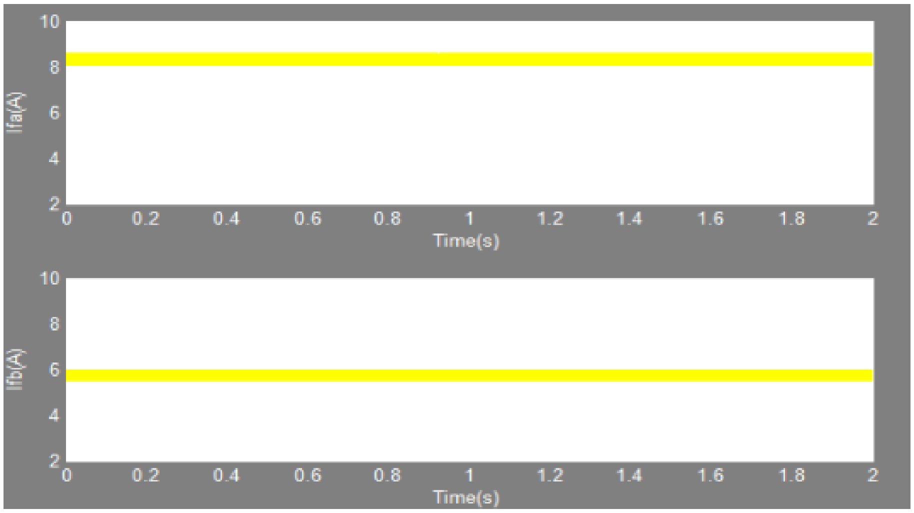
sub circuit





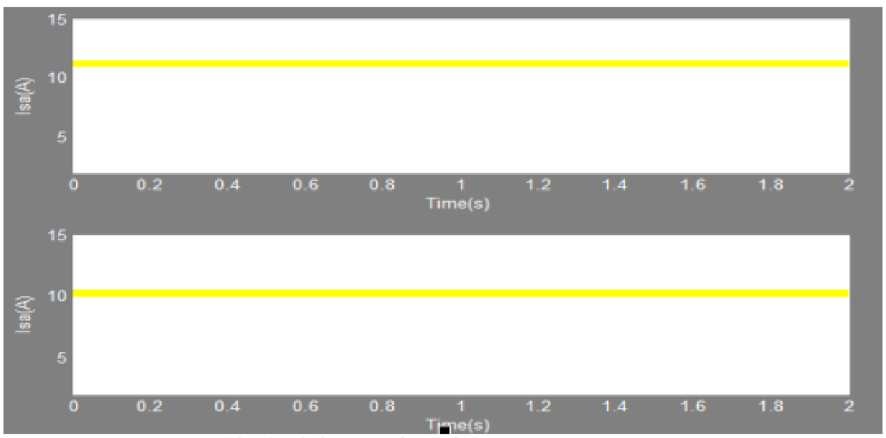
The simulation wave form of terminal voltages and source currents

a) Phase-a b) phase-b c) phase-c



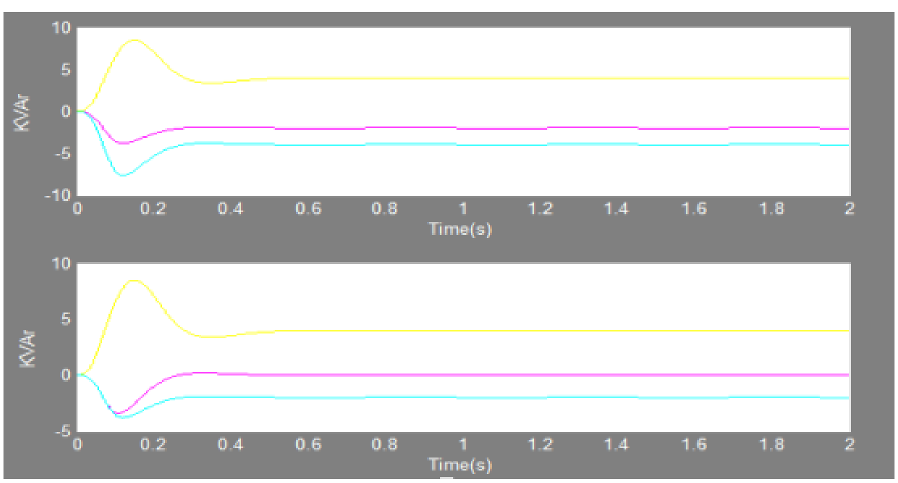
The simulation wave form of phase-a compensator rms currents

a) Old method b) new method



The simulation wave form of phase-a source rms currents

a) Old method b) new method



The simulation wave form of load(QL), compensator(Qvsi) and PCC(Qpcc)reactive powers

a) Old method b) new method

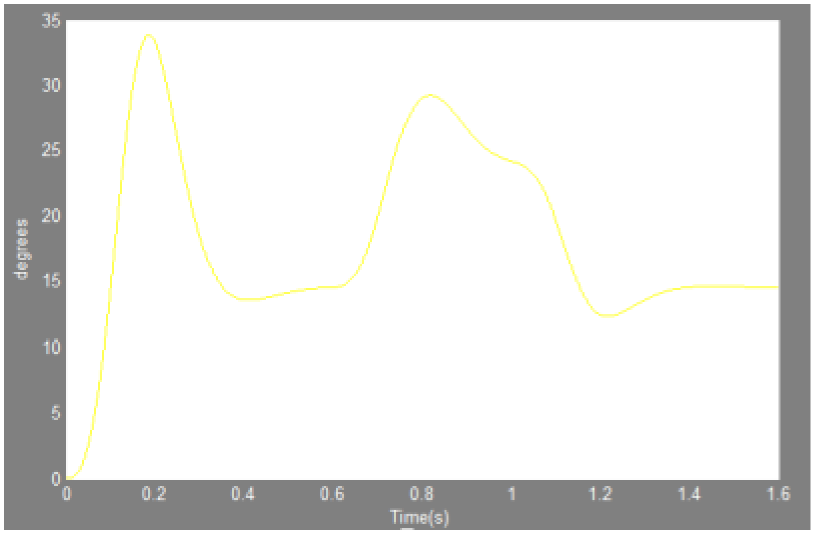
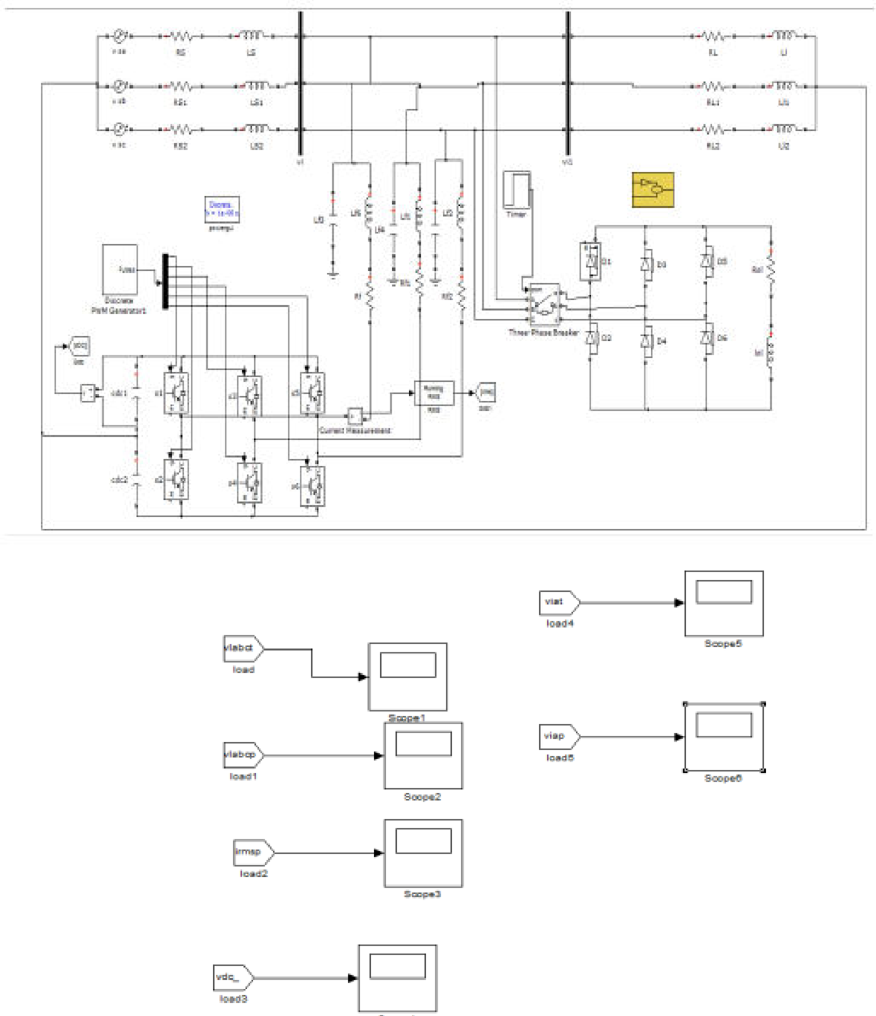
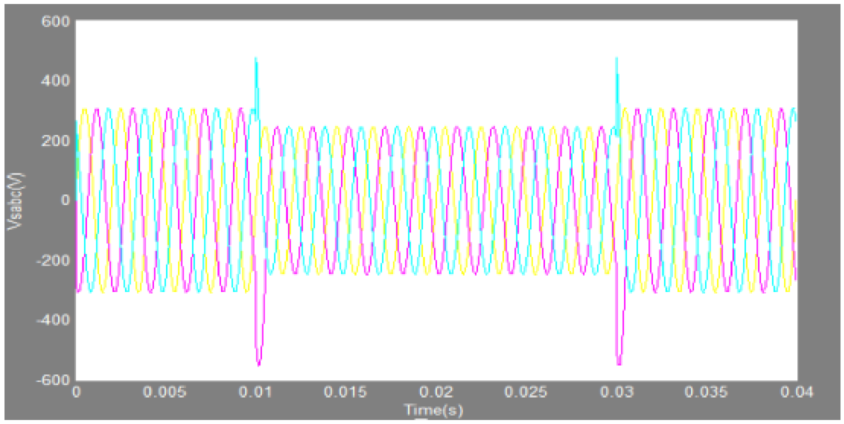
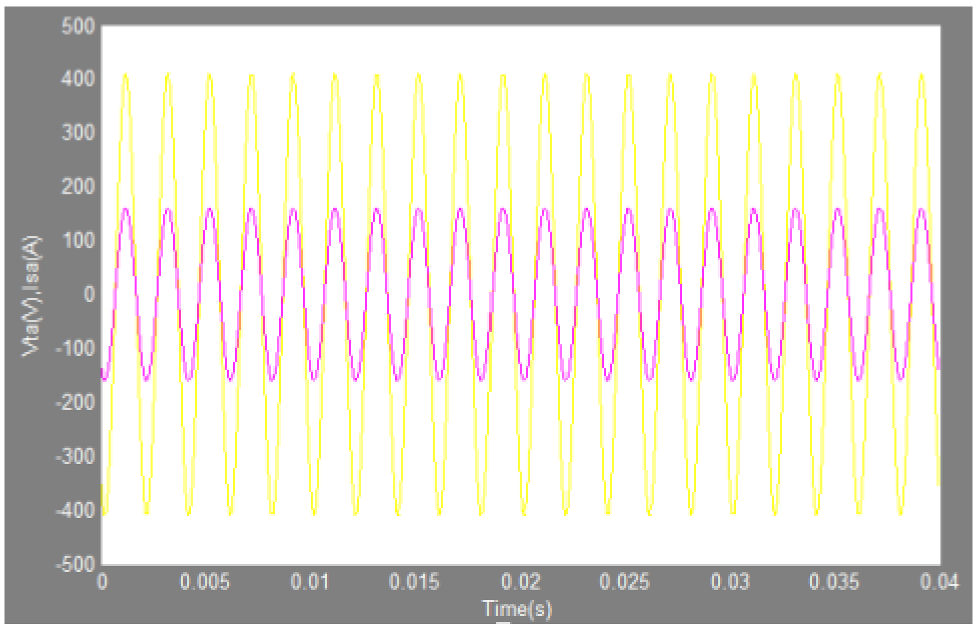


Fig.4: The simulation wave form of RES fed improved load angle

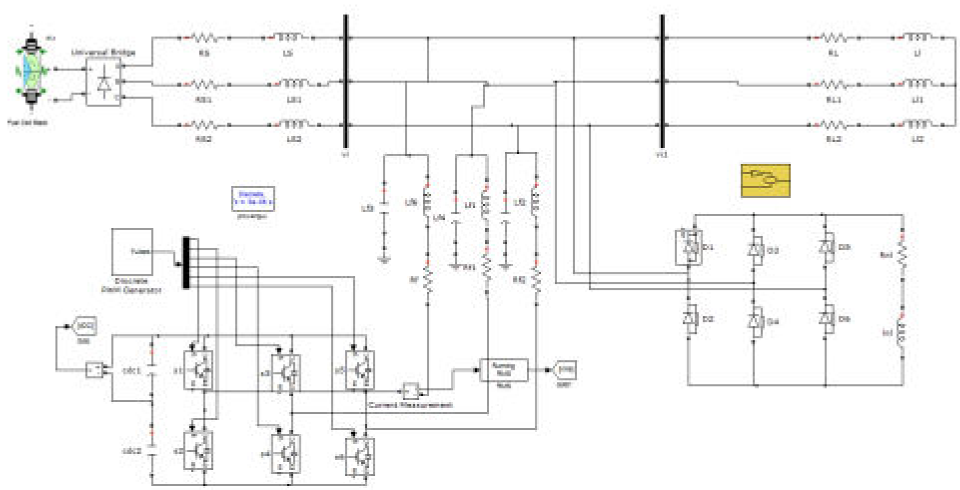


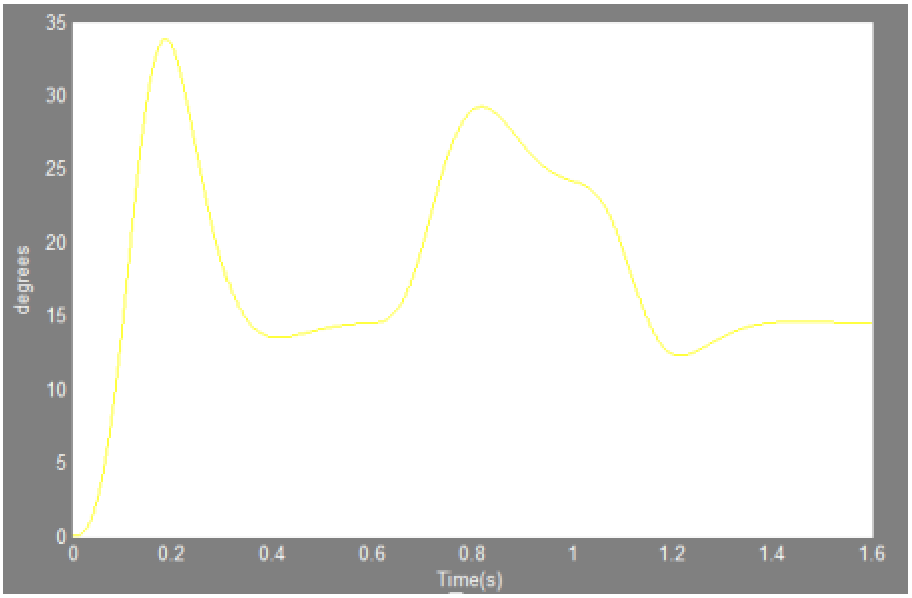


The simulation wave form of source voltage during sag

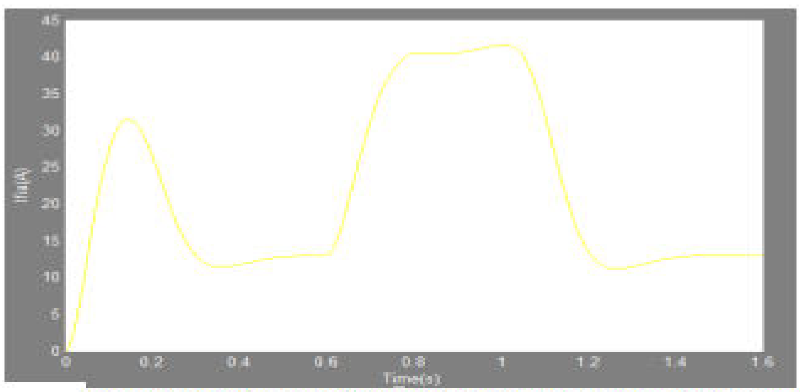


The simulation wave form of source and terminal voltage during load change

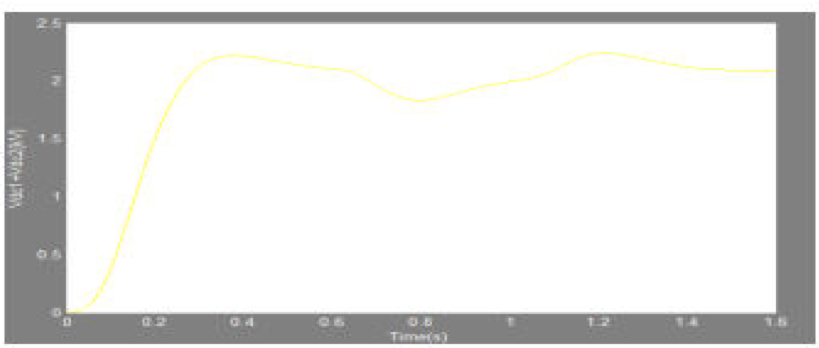




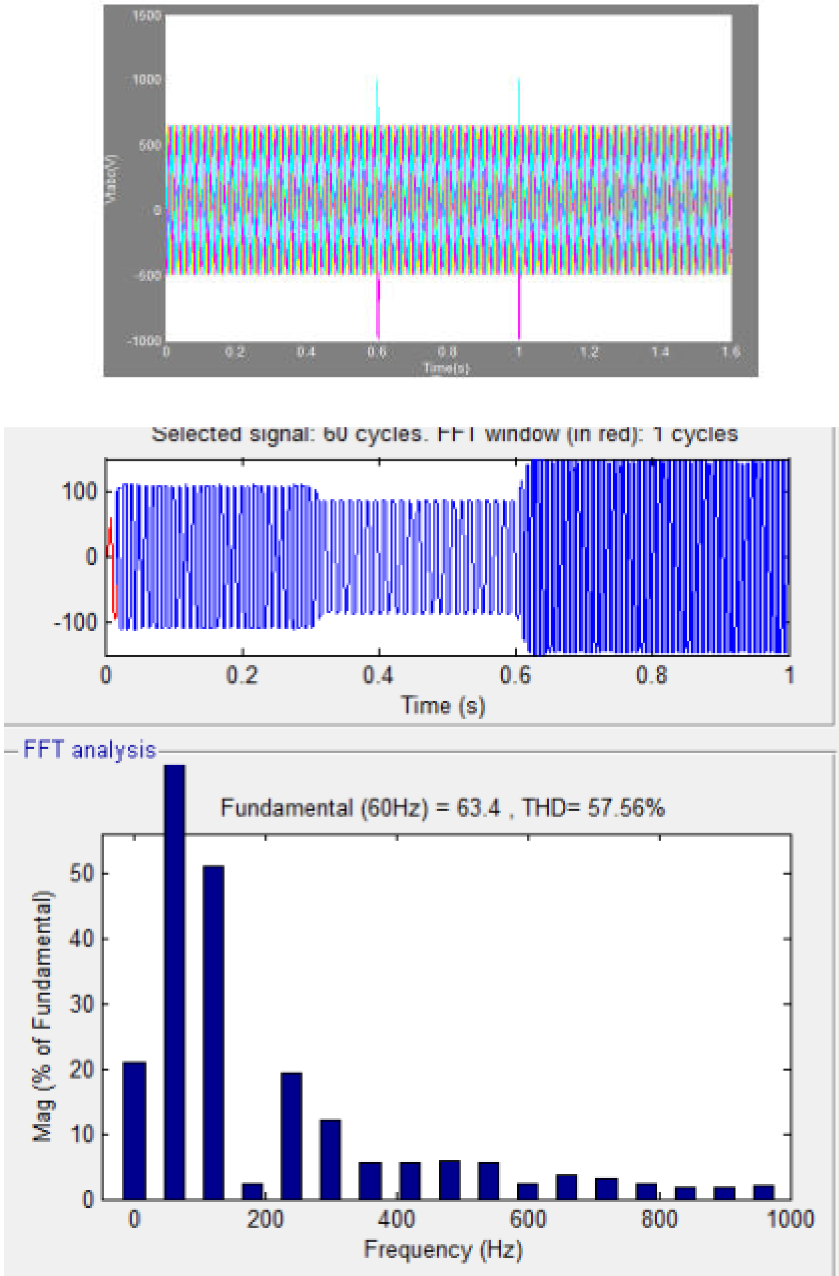
The simulation wave form of RES fed improved load angle



The simulation waveform of RES fed compensator rms current



The simulation wave form of RES fed DC voltage



The simulation wave form of RES fed terminal voltage

CONCLUSION

In this project, a new design has been proposed for the generation of reference load voltage for a voltage-restrained DSTATCOM. The performance of the proposed scheme is compared with the traditional voltage-restrained DSTATCOM. The proposed method provides the following advantages: • At nominal load, the compensator injects reactive and harmonic components of loadcurrents, resulting in UPF; • Nearly UPF is maintained for a load change; • Fast voltage regulation has been achieved during voltage disturbances; and • Losses in the VSI and feeder are reduced considerably, and have higher sag supporting capability with the same VSI rating compared to the traditional scheme. The simulation results show that the proposed scheme provides DSTATCOM, a capability to improve several PQ problems (related to voltage and current). In future, we can use this type of topology to fulfill our requirements, as this model gives more load current, more rms current, more dc voltage, more terminal voltage compared to the existing topology. Since the renewable energy sources are available in more quantity, they can replenish at any time and they are free of cost in some situations. Even though if there are any financial expenses if we spend one time the sources will last long time when compared to non-renewable energy sources. So, this project can serve any human being in future to meet their continuous power supply without any disturbances and they can lead a successful life.

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