TRAINING SEMINAR

Mastering Voltage and Reactive Power Control in Power Systems Using SVCs and STATCOMs

A practical, comprehensive introduction to SVC and STATCOM technologies for industrial, distribution and transmission networks

Presented by **Dr Tuan Vu**
Volt-Var and Control Power Systems Consultants Pty Ltd

Introduction

Voltage and reactive power control are at the heart of stable, reliable, and efficient power networks. With the rapid growth of renewable energy, electrified transport, and digital automation, the need for fast, dynamic reactive power compensation has never been greater. Static Var Compensators (SVCs) and STATCOMs are cutting-edge technologies that deliver rapid voltage support, boost power transfer capacity, and strengthen system stability, ensuring networks perform under both normal and fault conditions.

From transmission interconnectors and electrified rail systems to large-scale industrial loads, wind and solar farms, and advanced Volt-VAr Optimisation (VVO) in distribution networks, SVCs and STATCOMs are enabling the next generation of power system performance. They provide real-time reactive power support to manage fluctuations, reduce network losses, and optimise efficiency — playing a vital role in the transition to a cleaner, more resilient, and decentralised energy future.

Seminar Overview

This seminar provides a practical and comprehensive introduction to Static Var Compensator (SVC) and STATCOM technologies, equipping managers, engineers, and technicians from industry, DSOs, and TSOs with the essential knowledge to plan, specify, design, operate, and maintain these systems. With a strong focus on real-world applications across industrial, distribution, and transmission networks, participants will gain the skills and insights needed to optimise investment, reduce risk, and enhance performance in meeting the evolving demands of modern power systems.

Seminar Presenter | Dr Tuan Vu

Dr. Tuan Vu

PhD, FIEAust, CPEng, RPEQ, APEC Engineer, IntPE(Aus)

Manager Power Systems / Principal Consultant

Volt-Var and Control Power Systems Consultants Pty Ltd

Dr. Tuan Vu is a highly experienced Power Systems Engineer with over 30 years of expertise in the electricity supply industry and energy consulting across Australia and internationally. His expertise spans high-voltage (HV) and extra-high-voltage (EHV) projects, generator and large load (including data centre) connections, power quality (harmonics), network planning, Renewable Energy Zones (REZs), system strength, voltage stability, reactive power control, wind, solar and battery energy storage system (BESS) integration, substation design, National Electricity Market (NEM) connections, power system studies, fault investigations, and FACTS technologies (SVCs and STATCOMs).

Dr. Vu has successfully led multidisciplinary teams in the delivery of high-voltage capital projects valued at over **AUD $300 million**. He is also an active representative of Standards Australia, contributing to IEC standards development and participating in several CIGRE Working Groups.

Learning Outcomes

By attending this course, participants will:

Understand SVC & STATCOM Fundamentals

- Learn the principles and functions of SVC and STATCOM.
- Compare the advantages and limitations of each in different applications.

Gain Practical System Design Knowledge

- Learn to specify key parameters for various network scenarios.
- Understand cost-benefit trade-offs in project planning.

Enhance Grid Integration & Compliance

- Understand grid code requirements for reactive power support.
- Explore best practices for harmonic filtering and system stability.

Develop Operation & Maintenance Skills

- Learn performance monitoring, fault diagnostics, and maintenance strategies.
- Understand lifecycle management and asset optimisation.

Apply Real-World Case Studies & Best Practices

- Review successful SVC and STATCOM implementations.
- Learn lessons and best practices for maximising reliability.

This course will provide participants with the knowledge and skills to implement SVC and STATCOM solutions, optimise performance, and improve grid reliability.

Who Should Attend?

This course is for professionals involved in the procurement, planning, design, operation, and maintenance of SVC and STATCOM systems in industrial, distribution, and transmission networks. It is ideal for:

- Utility Engineers & Managers (TSOs and DSOs) responsible for voltage and reactive power control.
- Power System Engineers in network planning and grid stability analysis.
- Renewable Energy Developers & Operators managing wind, solar, and battery storage projects.
- Industrial Power Engineers handling large-scale industrial loads and electrified rail networks.
- Consultants & Technical Specialists supporting grid connection studies and power system modelling.
- Asset & Operations Managers overseeing reactive power compensation systems.

No prior experience with SVC and STATCOM is required, but basic knowledge of power systems and voltage management is beneficial.

Course Content

Day 1

Reactive Power Compensation in Power Systems	▪ Concepts of voltage control using SVC and STATCOM ▪ Power system improvements with reactive power control ▪ Voltage control and voltage regulation (positive sequence voltage control) ▪ Load balancing (negative sequence voltage control) ▪ Power factor correction ▪ Steady-state power transfer capacity ▪ Voltage stability and transient stability ▪ Power System Oscillation Damping (POD) ▪ FACTS controllers and applications ▪ Considerations for placement and sizing
Placement, Sizing and Characteristics of SVC and STATCOM	▪ Voltage–Current (V/I) characteristics – SVC versus STATCOM ▪ Steady-state and dynamic V/I characteristics ▪ Slope / droop in V/I characteristics ▪ Case study – SVC used to prevent voltage instability ▪ Harmonics, DC offset and negative phase sequence
Configurations and Implications – SVC vs. STATCOM	▪ Typical and common configurations ▪ SVC Thyristor Controlled Reactor (TCR) ▪ SVC Thyristor Switched Capacitor (TSC) ▪ STATCOM IGBT power modules ▪ Losses ▪ Harmonic performance

Day 2

Main Components of SVC and STATCOM	▪ Primary systems (HV plant) ▪ Power electronic switching (thyristor versus IGBT) ▪ Thyristor valves (TCR and TSC) – heart of the SVC system ▪ Manufacturing, components and performance ▪ Thyristor valve losses and valve cooling ▪ Thyristor triggering and monitoring ▪ IGBT power modules and DC capacitors (STATCOM) ▪ Two, three and multi-level IGBT modules ▪ Cooling systems; hardware examples ▪ Secondary systems (control and protection); auxiliary systems
Applications of SVC and STATCOM	▪ Integration of renewable sources – solar, wind and battery ▪ Distributed and centralised topologies ▪ Advanced Volt-VAr Optimisation (VVO) schemes ▪ Solutions to power quality issues – flicker, sag, unbalance and power factor ▪ Applications for industrial systems ▪ Applications for distribution systems ▪ Applications for transmission systems
Control, Protection and Monitoring Systems	▪ Typical functions of sequence control ▪ Start-up, shutdown and emergency shutdown sequences ▪ Control modes – automatic and manual ▪ Voltage regulation; voltage droop / slope ▪ Negative phase sequence balance ▪ Power Oscillation Damping (POD) control; stability control ▪ Q-optimisation schemes; under and over voltage schemes; degraded mode ▪ Conventional AC protection schemes ▪ SVC and STATCOM specific DC protection schemes

Day 3

Major Component Ratings	▪ Verification of major components' ratings ▪ Harmonic voltage and current stresses ▪ Practical exercise – verify SVC components' ratings
Project Overview	▪ Specifications and design reports ▪ Project schedule – key tasks, durations and milestones ▪ Construction and equipment installation ▪ Inspection and Test Plans (ITPs) ▪ Commissioning process – FAT and SAT ▪ Pre-energisation tests, Factory Acceptance Tests ▪ Post-energisation tests; systems tests
SVC and STATCOM Specifications	▪ Scope of works; particular specifications ▪ Primary plant; secondary systems – hardware and software ▪ Auxiliary systems ▪ Noise and electromagnetic interference specification ▪ Operation, maintenance, training and technical support ▪ General engineering requirements ▪ Administration, documentation and construction management ▪ Technical schedules; commercial conditions; sample specifications
Operation, Maintenance and Refurbishment	▪ Training and specialist skills ▪ Asset management – operation and maintenance knowledge ▪ Fault investigations – catastrophic failures ▪ Spares and inventories ▪ Refurbishment plan – secondary and primary systems

Registration Fees and Details

Registration Contact	**Dr Tuan Vu** *Manager Power Systems / Principal Consultant* M: +61 407 372 483 E: admin@vvcpowersystems.com.au
Venue	Course to be conducted at Client's Office
Fees	$1,500 per person (minimum 10 participants), or $20,000 per course for 15 participants
Duration	3-day training seminar
Course Materials	Soft copies (PDF)

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