

FACTS Mastery: Power Flow and Transmission System Control Training

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Course Overview

The Advanced FACTS Training: Power Flow and Transmission System Control course provides participants with a comprehensive understanding of Flexible AC Transmission Systems and their critical role in modern electrical networks. The course integrates both theory and applied practice, focusing on advanced FACTS devices such as the Static Synchronous Series Compensator SSSC and the Distributed Power Flow Controller DPFC. Participants will develop practical skills to analyze, model, and control power flow, optimize grid stability, and enhance system reliability using modern techniques in reactive power compensation and dynamic control.

This power system control course offers a holistic approach to mastering FACTS controller training and practical power electronics applications, aligned with industry needs in smart grid engineering, renewable integration, and advanced grid technologies.

CPD Course Listing

The Advanced FACTS Training: Power Flow and Transmission System Control course is listed on the CPD portal as part of our commitment to delivering structured, industry-relevant professional development. Participants, employers, and sponsoring organizations can review the course listing and its continuing professional development details through the official CPD portal.

View This Course on the CPD Portal

Target Audience

- Power system engineers and electrical network operators
- Energy control and protection engineers
- Smart grid and automation specialists
- Transmission planners and consultants
- Academic professionals and postgraduate electrical engineers

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Targeted Organizational Departments

- Power transmission and distribution units
- Control and automation departments
- Smart grid development and digital substation divisions
- Electrical engineering R&D centers
- Renewable energy integration and optimization teams

Targeted Industries

- Power generation and transmission companies
- Renewable energy and hybrid system providers
- Industrial facilities relying on stable electrical distribution
- Engineering consulting firms and design contractors
- Government agencies and utilities regulating energy infrastructure

Course Offerings

By completing this training, participants will be able to:

- Design and implement FACTS devices in power systems to improve efficiency
- Simulate SSSC and DPFC models for power flow management and grid control
- Apply optimization techniques to voltage and reactive power regulation
- Evaluate FACTS integration in smart grids for load balancing and reliability
- Interpret system performance metrics and harmonics mitigation strategies
- Develop implementation frameworks for FACTS-based system enhancements

Training Methodology

The course uses a blended approach of expert instruction, technical demonstrations, group collaboration, and hands-on simulation activities. Participants will analyze real-world case studies and interpret simulation results related to FACTS and DPFC systems. Interactive discussions, peer evaluations, and scenario-based exercises strengthen conceptual understanding and technical application. The program also includes guided workshops and modeling sessions focusing on FACTS device coordination and performance optimization in power systems.

Course Toolbox

- Course workbook and digital lecture slides
- FACTS modeling templates and case-based exercises
- Power flow control diagrams and fault simulation models
- Technical glossaries for FACTS terminology and devices
- Worksheets for system optimization and performance evaluation
- Implementation checklist for SSSC and DPFC operation and maintenance

Note: Tools are not physically provided; the course focuses on knowledge, insights, and real-world examples.

Course Agenda

Day 1: Fundamentals of FACTS and Transmission Control

- **Topic 1:** Principles and evolution of Flexible AC Transmission Systems
- **Topic 2:** Classification and functions of FACTS devices in power systems
- **Topic 3:** Fundamentals of power flow control and system constraints
- **Topic 4:** Reactive power compensation and voltage regulation basics
- **Topic 5:** Overview of FACTS architecture and control structures
- **Topic 6:** Emerging trends in smart grid engineering and automation
- **Reflection & Review:** Key learnings and introduction to advanced FACTS applications

Day 2: Static Synchronous Series Compensator SSSC Mastery

- **Topic 1:** SSSC operating principles and system configuration
- **Topic 2:** Power injection control and phase shifting mechanisms
- **Topic 3:** Harmonic reduction and resonance mitigation using SSSC
- **Topic 4:** Comparative analysis of SSSC versus TCSC and STATCOM
- **Topic 5:** SSSC implementation in long-distance transmission networks
- **Topic 6:** Control strategies and protection schemes for SSSC applications
- **Reflection & Review:** Lessons learned and case analysis on SSSC effectiveness

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Day 3: Distributed Power Flow Controller DPFC and Modern Solutions

- **Topic 1:** Concept and architecture of Distributed Power Flow Controller
- **Topic 2:** Coordination between shunt and series controllers
- **Topic 3:** Control algorithms and synchronization strategies in DPFC systems
- **Topic 4:** Practical benefits and challenges of modular DPFC design
- **Topic 5:** DPFC applications in reactive power management and load balancing
- **Topic 6:** Advanced DPFC protection and fault response scenarios
- **Reflection & Review:** Discussion on DPFC reliability and performance comparison

Day 4: Grid Optimization and FACTS Integration

- **Topic 1:** Advanced optimization techniques for FACTS device placement
- **Topic 2:** Integration of FACTS with renewable and hybrid energy sources
- **Topic 3:** Real-time monitoring and SCADA-based FACTS control systems
- **Topic 4:** Power electronics innovations for next-generation grid control
- **Topic 5:** Data-driven analysis for FACTS operation and maintenance planning
- **Topic 6:** Adaptive control models for multi-terminal and distributed systems
- **Reflection & Review:** Key insights from optimization projects and simulations

Day 5: Operations, Maintenance, and Future Developments

- **Topic 1:** FACTS system commissioning and performance validation
- **Topic 2:** Maintenance planning and troubleshooting for FACTS devices
- **Topic 3:** Risk management and safety protocols in FACTS deployment
- **Topic 4:** AI and digital twin applications in smart grid monitoring
- **Topic 5:** Case studies of global FACTS installations and results
- **Topic 6:** Future directions: FACTS evolution in next-generation power systems
- **Reflection & Review:** Recap, participant presentations, and final course insights

FAQ

What specific qualifications or prerequisites are needed for participants before enrolling in the course?

A basic background in electrical, power, or control engineering is recommended. Familiarity with transmission or grid systems will help participants fully engage in simulation exercises.

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How long is each day's session, and is there a total number of hours required for the entire course?

Each daily session runs approximately 4–5 hours, totaling around 25 hours of instruction, discussion, and exercises over one week.

How do FACTS controllers enhance grid reliability and renewable integration?

FACTS controllers regulate voltage, improve power factor, and stabilize power flow in real time. This allows for efficient renewable energy integration, load balancing, and enhanced system reliability across the grid.

How This Course is Different from Other Advanced FACTS Courses

This program stands out by combining theoretical depth with practical, application-driven exercises in FACTS controller training. It emphasizes hands-on modeling, live performance analysis, and optimization techniques to simulate real transmission scenarios. The course integrates advanced practices in SSSC and DPFC control with current smart grid developments, preparing participants to lead engineering teams in implementing efficient, flexible, and future-ready power systems.

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- Communication and Public Relations Training Courses
- Crisis Management and Business Continuity Training Courses
- Data Analytics Training and Data Science Courses
- Digital Government & Public Service Training Courses
- Education and Learning Development Training Courses
- Environment & Sustainability Training Courses
- Facilities and Real Estate Training Courses
- Finance and Accounting Training Courses
- Governance, Risk and Compliance Training Courses
- Healthcare Management Training Courses
- Heritage Conservation and Museum Management Training Courses
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- IT Security Training & IT Training Courses
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