

Section I

# Flexible AC Transmission Systems (FACTS)

Models, Control and applications



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## Course Material

- The Basic concept of compensation and compensators in power systems.
- Application of state-of-the-art high power electronics to power transmission and distribution systems.
- Introduce basic FACTS controller concepts and applications.
- The emphasis will be on three important application areas of Flexible AC transmission Systems (FACTS) and Custom Power devices and high voltage direct current (HVDC) transmission systems.

## **Course Material**

The course concentrates on studying the most common thyristor-controlled FACTS controllers, in particular:

1. Static Var Compensators (SVC),
2. Thyristor-Controlled Series Compensators (TCSC)
3. Thyristor Controlled Voltage and Phase Regulators (TCVR and TCPAR),
4. Voltage-sourced converter controllers, specifically the Static Compensator (STATCOM) Static Synchronous Series Compensator (SSSC),
5. The Unified Power Flow Controller (UPFC)
6. Some other devices such as: DPFC, DVR.

## **Course Material**

- Study in detail the most popular FACTS controller structures and their functionality.
- Detailed and approximate models for various control strategies and practical applications of these controllers are discussed.
- Introduce detailed and approximate models and their use for these controllers.
- Discuss practical control strategies and applications of these FACTS controllers.

## **Course Material**

### **Application in :**

- power load flow,
- improving dynamic power system,
- improving transient power system,
- Increasing power system reliability
- improving power quality system.

Topic	Sub-Topics
FACTS Concepts	<ul style="list-style-type: none"> <li>• Shunt and series compensation</li> <li>• Voltage and oscillation control</li> <li>• FACTS- Definitions, Types of FACTS, HVDC versus FACTS</li> </ul>
Thyristor-controlled FACTS	<ul style="list-style-type: none"> <li>• SVC- Functional description and structure, detailed model, approximate models, controls and applications</li> <li>• TCSC- Functional description and structure, detailed model, approximate models, controls and applications</li> <li>• TCVR and TCPAR- Functional description and structure, detailed model, approximate models, controls and applications</li> </ul>
Voltage-sourced converter FACTS	<ul style="list-style-type: none"> <li>• STATCOM- Functional description and structure, detailed model, approximate models, controls and applications</li> <li>• SSSC- Functional description and structure, Detailed model, Approximate models, Controls and applications</li> <li>• UPFC- Functional description and structure, Detailed model, Approximate models, Controls and applications</li> </ul>

## References For Section I

<b>N. G. Hingorani and L. Gyugi</b>	<b>Understanding FACTS: Concepts and Technology of Flexible AC Transmission Systems, IEEE Press, 2000.</b>
CIGRE TF 38.01.08, Technical Brochure 145, August 1999.	Modeling of Power Electronics Equipment (FACTS) in Load Flow and Stability Programs”,
IEEE-PES 96TP116-0, 1996	FACTS Applications
	Conference and Journal papers
	Course Notes

## **Background :**

- power electronic converters,
- Electrical machine dynamic simulation including: Dc machine, Induction machine, synchronous machine
- Multi-level power converter and matrix converters
- PWM and Space Vector Modulation (SVM)
- Load power flow
- Standard bench mark power system



## مرجع فارسی:

1- سیستم های انتقال جریان متناوب انعطاف پذیر FACTS «مفاهیم و کاربردها» نوشته محمود جورابیان ، قره پیتیان، میرعباسی

- اصول جبران سازی و جبران سازی متعارف
- ادوات فکتس جبران شده با تایرستور
- ادوات فکتس بر پایه مبدل منبع ولتاژ
- مدل سازی عناصر فکتس در محاسبات پخش بار
- کاربرد ادوات فکتس به منظور کنترل پخش بار
- کاربرد ادوات فکتس برای افزایش پایداری دینامیکی سیستم قدرت
- بهبود پایداری گذارا توسط ادوات
- قابلیت اطمینان با ادوات FACTS
- بهبود کیفیت توان

2- سیستم های انتقال انعطاف پذیر AC گزارش پروژه جایابی ادوات FACTS برای شبکه انتقال استان سیستان و بلوچستان : برکاتی ، قره ویسی

3- اساید های درس