

OUTLINE

Controlled Generator on Grid

- The main functions of an Automatic Voltage Regulator (AVR)
- The main functions of a Power System Stabilizer (PSS)

How to test an AVR system

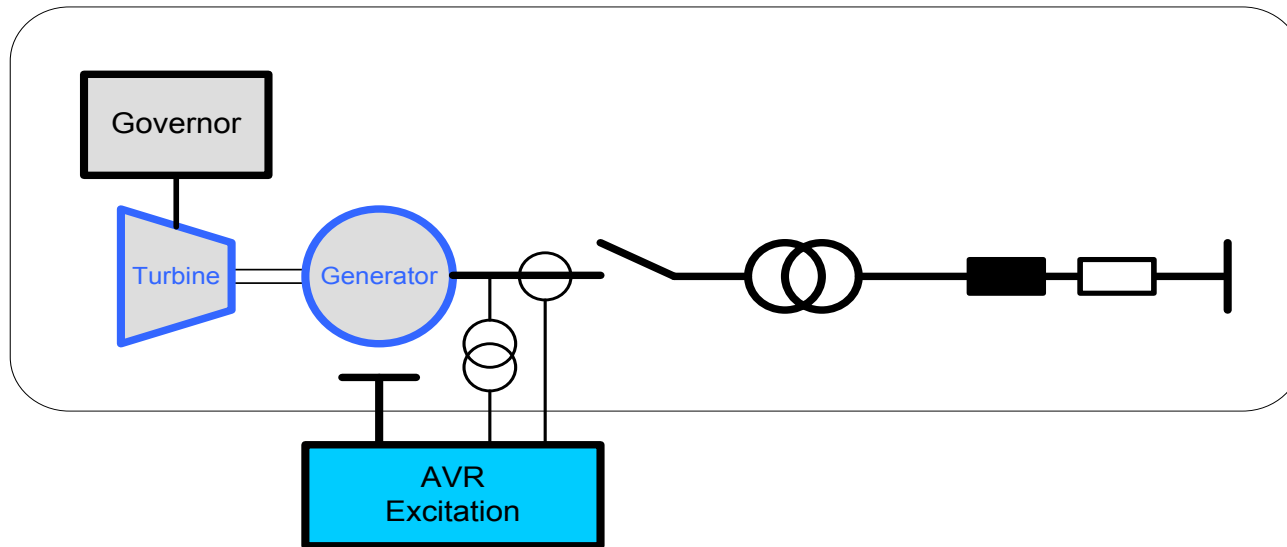
- Introduction to Real Time Simulator

Grid Code compliance testing

- UNITROL built in compliance test functions

Synchronous Machine Transient Simulator

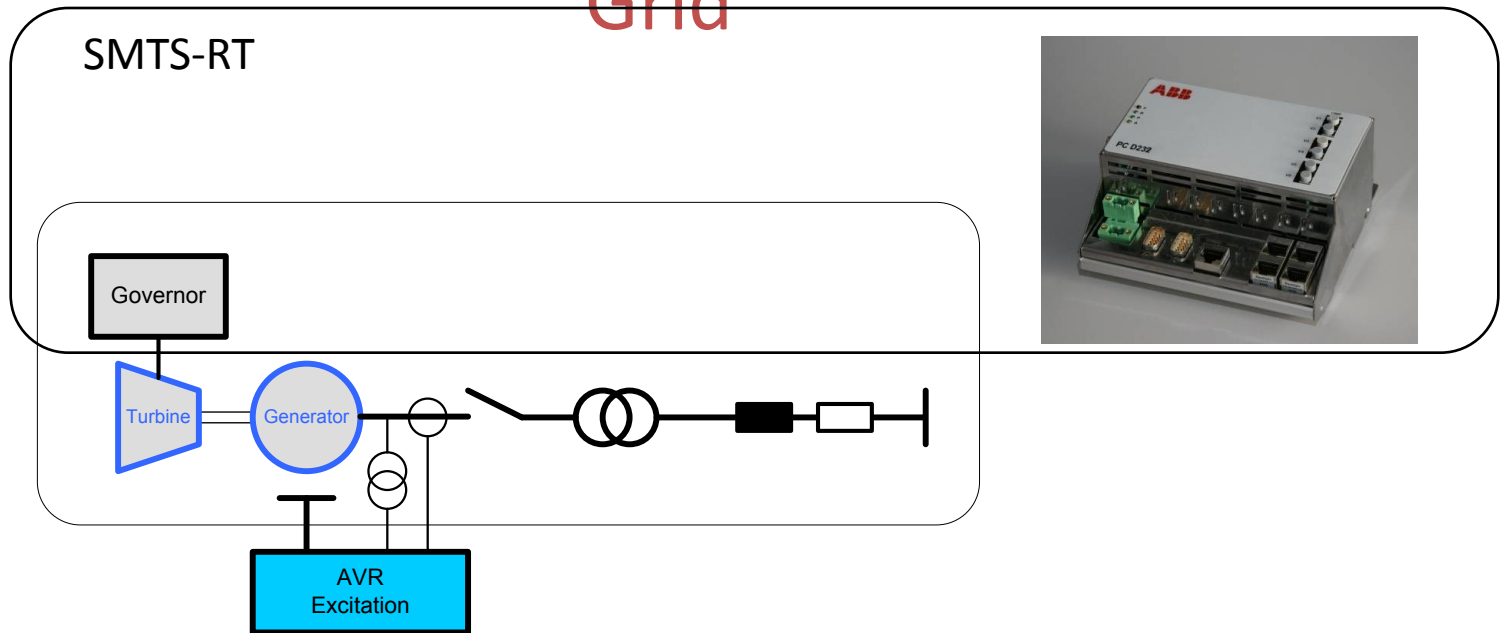
Turbine, Generator, Transformer, Line to infinite Bus



Typical turbine - generator arrangement in a power plant
Automatic Voltage Regulator (AVR)

Synchronous Machine Transient Simulator

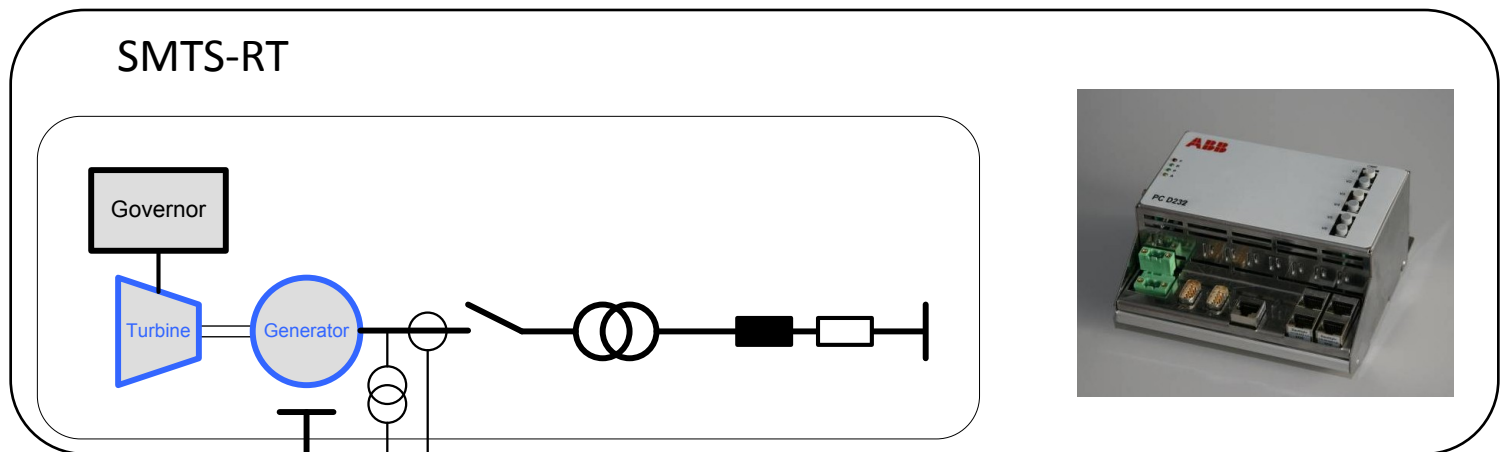
Turbine, Generator, Transformer, Line to infinite
Grid



Real Time Simulation of
Turbine and governor (simplified)
Generator
Breaker and step-up transformer
Grid representation with infinite Bus Voltage

Synchronous Machine Transient Simulator

Turbine, Generator, Transformer, Line to infinite Grid

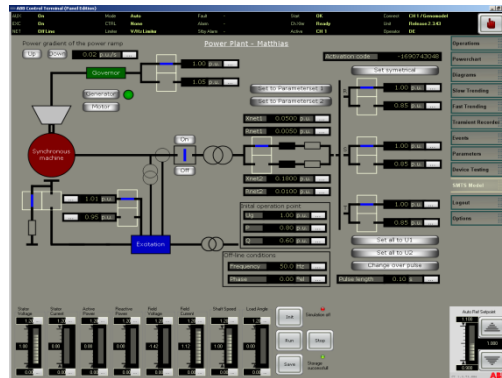


AVR hardware in
the loop
Real Time
Simulation



Synchronous Machine Transient Simulator

Turbine, Generator, Transformer, Line to infinite Grid



SMTS-RT 6000



UNITROL 6000



Synchronous Machine Transient Simulator

SMTS-RT 6000; User Interface

ABB Control Terminal (Panel Edition)

Mode: **Auto** Fault: - Start: **OK** Connect: **CH 1 / Genomodel**
EXC: **On** CTRL: **None** Alarm: - Ch'cter: **Ready** Unit: **Release 2.343**
NET: **Off Line** Limiter: **V/Hz Limiter** Stby Alarm: - Active: **CH 1** Operator: **DE**

Power gradient of the power ramp: **0.02 p.u./s**

Power Plant - Matthias

Activation code: -1690743048

Operations: Set symmetrical

Parameters: Xnet1: 0.0500 p.u., Rnet1: 0.0050 p.u., Xnet2: 0.1800 p.u., Rnet2: 0.0100 p.u.

Initial operation point: Ug: 1.00 p.u., P: 0.80 p.u., Q: 0.60 p.u.

Off-line conditions: Frequency: 50.0 Hz, Phase: 0.00 °el

Pulse length: 0.10 s

Stator Voltage: 1.20 p.u. Stator Current: 1.20 p.u. Active Power: 1.20 p.u. Reactive Power: 0.00 p.u. Field Voltage: 1.20 p.u. Field Current: 1.20 p.u. Shaft Speed: 1.20 p.u. Load Angle: 1.20 p.u.

Buttons: Init, Run, Stop, Save

Auto Ref Setpoint: 1.100 V

ABB logo

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AVR Grid Code Compliance

Grid Code Example

Excerpt from of a local grid code:

“Overall Excitation System Control Characteristic

...The frequency domain tuning of the Power System Stabilizer shall also be demonstrated by injecting a 0.2Hz-2Hz band limited random noise signal into the Automatic Voltage Regulator reference... while the Generating Unit is operating at a typical load level...

...The damping contribution of the Power System Stabilizer shall improve the system-stability within the frequency-band of interest (compared to the system response without a stabilizer):

i.e., 0.2Hz - 2Hz”