

Data Acquisition System for Synchronous Generator Transient Performance

Team name
PREW Generation



Agenda

- 1- The Goal Of The Project. (what? & How?)
- 2- History of the project.(Previous related projects)
- 3- Questions about the equipment.(Rated parameters,how to use and for what?)
- 3- Understanding the schematic of the Generator/Motor.
- 4- Client Contact.



The Goal of the Project (What? & How?)

What we need to measure:

1. Speed
2. Torque
3. Load phase angle
4. Terminal current
5. Terminal Voltage
6. Field current
7. Field Voltage
8. Power



How ?



Measurements

Machine voltage, 1, 2 or 3 phase	up to 500 V _{AC}
Machine current, 1 phase	1 to 5 A _{AX}
Network voltage, 1 phase	up to 500 V _{AC}
Frequency range	10 to 150 Hz
Accuracy	< 1%

Exciter current measurements

Full range	0 to 40 A
Accuracy	< 1%
Resolution	< 100 mA



How ?

Using PMU to calculate the phase load angle.



History of the project

EXCITATION CONTROL OF A SYNCHRONOUS GENERATOR

Presented By Team: Three Phase

OBJECTIVE
The goal of the project is to specify, purchase, install, and commission a static exciter for the synchronous generator in the University of Idaho Model Power System (BEL Power) Lab, including a verified RTDS system model.

WHAT IS AN EXCITER?
An exciter is a control system that controls the output of a generator (terminal voltage or VARs depending on the system).

PURCHASING
PROJECT SPECIFICATIONS

ITEM	ITEM #	DESCRIPTION	PRICE
PHYSICAL EXCITER	1	ABB 1020	\$15,000.00
PHYSICAL CONTROL	2	ABB 1020	\$15,000.00
SOFTWARE	3	ABB 1020	\$15,000.00
WIRE DIAGRAM	4	ABB 1020	\$15,000.00
DIGITAL MODEL	5	ABB 1020	\$15,000.00
STC SUPPLY MODEL	6	ABB 1020	\$15,000.00

The Unirot-1020 from ABB was purchased after comparing products from three companies.

WIRE DIAGRAM
This diagram only shows the physical connections and omits the control circuit (digital and analog I/O).

DIGITAL MODEL
This model is based off of information provided by ABB and has been compared to an RScad library exciter model.

STC SUPPLY MODEL

FUTURE PROJECTS

- Real Time Hardware in Loop simulation
- Power System Stabilizer upgrade

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Adjustable Governor for Synchronous Generator

Project Goal: Design, simulate, and implement closed-loop frequency control on a small power system to govern it such that it dynamically responds as if it were a different, larger generator driven by hydro, steam, or gas.

Current Progress: The team is able to read shaft-position encodings from an absolute encoder, calculate instantaneous radial frequency, and dynamically alter the VFD's reference speed. Additionally, simulations of a hydro-electric generator have been developed in RTDS as a starting point for future system simulations.

Implementation

A microprocessor accepts readings from an absolute position-encoder, uses adjacent readings to calculate instantaneous radial frequency, and performs a reference correction or re-assignment by outputting the new desired speed config. via Modbus and the Embedded Feedback Interface of the VFD.

Simulation

Modbus and the Embedded Fieldbus

- Capable of safety starting and stopping the VFD.
- Low overhead packet sizes are approximately 5-72 milliseconds in length.
- Current implementation can alter radial frequency set-point dynamically by sending a single Modbus packet.

RTDS Modeling

- The RTDS model has been developed to simulate the system response of a hydro-electric generator.
- Frequency change plot on right.
- Normal operation of the RTDS model in the system response are ultimately used to control both the real & reactive power system.
- A data relationship will be used to transfer function from the RTDS and integrate it into the feedback system.

Encoder Frame

- Data is clocked in with a 875 kHz clock.
- One encoder position has 33 bits of resolution which equates to approximately 1 bit per lap.
- Absolute shaft position is stored by dividing the binary frame value by 0.04.

Sequential Encoder Positions

- Each group of 1,000 encoder samples takes 75 milliseconds to capture.
- The large step from 0.0024 to 0 is where the encoder encounters a zero-crossing.
- The discrepancy between the first chart and the second is due to time-lag.
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Byte - Back

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Questions about the equipment

Battery in the back of
ABB UNITROL1020.

It supplying DC to..



Questions about the equipment

Flashing Active ?

Flash field? And others, connected to ABB UNITROL1020.



Understanding the schematic of the Generator/Motor



Underdanig the schematic of the Generator/Motor



Client Contact

How often we have to meet with Norman Fischer.
Email ?

