Project 29

Testbed for Measurement and Control of Generator Power Oscillations



Team name: Shockwave Team member: Zuhao Zhou Quan Yan Changyao Xu Yutong Chen Sponsor: SCHWEI ZER RING RIES **Client**: Matchyaraju Alla



Objective

- Building on the data acquisition system designed by a 2018-
- 2019 senior design team design a test bed and test plan for
- testing generator performance during power swings, especially
- those near boundary of pole slipping



Requirement

1.Make connections in the system look more professional

2. Due to changes in connections, the system can be easy disconnected and connected

3. Variable testbed should have an ability to characterize different machines



Project Learning

Data Acquisition System



An encoder is required to measure speed and the Z The Himmelstein MCRT 48202V(1-3) Torque pulse signal. The encoder we used is the BEI Sensors H25 Incremental Optical Encoder. The Z pulse is used in tandem with the zero crossing of a terminal voltage to calculate the load phase angle.

Transducer outputs an analog voltage proportional to the current torque on the shaft. The average torgue can be calculated from the peak torque in the induced harmonic.

The National Instruments PXI 6251 Data Acquisition Board captures and digitizes analog signals. The PXI chassis then sends the signals to the computer through a PCI connection.

National Instruments PXI 6289 & 6251





PXI 6289)
Channel #	Signal
0	VA
1	V _B
2	Vc
3	Ι _Α
4	Ι _Β
5	lc
6	V_{DC}
7	I _{DC}
PXI 6251	L
Channel #	Signal
2	Z _{Encoder}
3	VA
4	Torque



LABView panel



The final human machine interface in LabVIEW displays all captured measurements simultaneously.



LABView Block Diagram





DC Circuit

R1 R2 Field R2 Field Current Field Current



Connect the circuit between the DC source and generator excitation side

R2 is for field voltage measurement

R3 is for field current measurement

PXI 6289							
Channel#	Signal						
0	V_A						
1	V_B						
2	V _C						
3	I _A						
4	I _B						
5	Ι _C						
6	V _{DC}						
7	I _{DC}						
PXI 6251	-						
2	Z _{Encoder}						
3	V_A						
4	Torque						



DC Circuit



1 st Time	Measured	Actual
R3	0.4Ω	0.1Ω
R2	1.001kΩ	1kΩ
R1	19.91kΩ	20kΩ
2 nd Time		
R3	0.2Ω	0.1Ω
R2	1.001kΩ	1kΩ
R1	19.91kΩ	20kΩ



Field V&I Measurement

	Applied Voltage	Measured V _{R2}	Ratio V_{ap}/V_{R2}
1 st Test	90V	4.309v	20.887
2 nd Test	100V	4.788V	20.886
3 rd Test	110V	5.266V	20.889
Ratio Average			20.888



CT-Current Transformer



Model	Rating	Ratio
114-151	150A : 5A	30 : 1

PXI 6289)
Channel#	Signal
0	V_A
1	V_B
2	V _C
3	I _A
4	I_B
5	I _C
6	V _{DC}
7	I _{DC}
PXI 6251	
2	Z _{Encoder}
3	V_A
4	Torque



Potential Transformer

Model	Rating	Specified Ratio
FS24-500	230V:12V	19.2:1





Page 14 Pt connection method



PXI 6289

Encoder





$$\theta_{NL} = (\frac{T_{NL}}{T} \times 360^{\circ})$$

$$\delta = \theta_{UL} - \theta_{NL}$$





Terminal Voltage Waveform and Encoder Pulse Signal (Loaded)





Torque Transducer





Page 17 Connection Box Solid Model





Design Considerations

Material of Testbed board

Polyvinyl chloride(PVC)

Pros:

- 1) Cheap
- 2) Lighter Material
- 3) Non-conductive
- 4) Environmentally friendly
- 5) Easy to cut

Cons:

1) Low heat resistance

Polypropylene(PP)

Pros:

- 1) High heat resistance
- 2) Lighter Material
- 3) Non-conductive

Cons:

- 1) Aging due to the action of light, heat and oxygen
- 2) High static electricity



Page 19 Design Considerations



1) Soldering

2) Change cable connector



Project Schedules

Before the end of fall semester 12/20/2019:

Complete all designs of testbed

Before the start of spring semester 01/15/2019:

Give the draft of the measurement plan

Spring semester:

Jan-Feb: Manufacture the Testbed

Feb-Apr/10/2020: Collect the data of generator performance during power swings (near boundary of pole slipping)

Apr/10/2020: Documentation





Capstone Project Budg	jet Templa	te - Fall/	Spring										
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quipment/Tools:	1												
Testbed board materials					\$ 40				\$	40			
Terminal strip	1				\$ 15				\$	15			
PVC/PP Cutter	1				\$ 15				\$	15			
ravel:	-												
	-								\$	-			
	1								\$	-			
	1												
upplies / Parts / Services:													
Expo display board								\$ 200	\$	200			
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											Budget	Excess	

Question



