Minutes of Generator Subcommittee

July 28, 2010

Chairman: John Ready
Vice Chair: Kay Chen
Secretary: Mohamed El-Sharkawi

Chairman John Ready called the meeting to order at 10:00AM. Attendees were introduced, 34 were present. The 2009 minutes were approved and the 2010 agenda was approved without any change

The chairman reported on GSC activities last year. The GSC Annual Report (2010) is separately posted on the GSC website.

The chair recognized the following two exceptional accomplishments:

- Bill Bartley's WG IEEE 1665 on Generator rewind guide was this year's recipient of the best new standard award.
- Haran Karmaker's WG revision of IEEE Std 115 – Guide for Test Procedures for Synchronous Machines was concluded

Working Group Reports

WG1: Award and Recognition, Nils Nilsson:

Nils Nilsson reported on the various nominations and awards made by his WG. He recognized Osama Mohamed for receiving the 2010 Cyril G. Veinott Electromechanical Energy Conversion Award, Chuck Wilson for the distinguished service award, and the new fellows. He encourages the members to be active in nominating people for the Tesla award as well as for fellows. A copy of his report is attached.

WG 2: Advisory Group to IEC, John Amos

The WG is inactive; no report is made in the last several years. The GSC chair is to correspond with John Amos to explore ideas on how to proceed with this WG. A motion was made and approved to make this WG under EMC instead of GSC.

WG 3: Generator Rewind Guide, Bill Bartley

IEEE Std 1665 is done. The WG is congratulated for their excellent work.

WG 4: Grid Induced Torsional Vibration, Tom Wait

The chair of the EMC reported on behalf of Tom Wait who couldn't attend. The WG work is ending and will be reported in a future panel as well as a WG paper. A motion was made and approved to have the panel on the subject in 2011

WG 5: Revision of IEEE 492, Robert Brummond

The WG has 6 new members and is currently working on a PAR to authorize the revision of IEEE std. 492.

WG 6: Application Guide for Superconducting Machines, Kiruba Sivasubramaniam Haran

The WG is collecting information on enabling technology and applications. The plan is to prepare a WG paper for next PES meeting.

WG7: Revision of IEEE 115, Haran Karmaker

The PAR approval and the work are done. Another PAR is approved for testing superconducting machines. The WG is closed.

WG 8: Harmonization of IEC and IEEE – IEEE C50, Kay Chen

Effort is almost complete. A decision is not made to apply for a PAR.

WG9: Renewable Energy Machines and Systems, Mohamed El-Sharkawi

The WG organized two sessions that were well attended. The WG will need bigger rooms next year.

Four panels are proposed for 2011: 1) Ocean energy generators; 2) Failure characteristics and Maintenance requirements of wind machines; 3) Impacts of LVRT requirements on wind machines; and 4) Wind Park Modeling.

One Tutorial is proposed on Maintenance and operation requirements for wind systems.

The joint WG on Fault Current Contributions from Wind Plants is very active and their report is attached. This WG is joint between the T&DC (Reigh Walling, Chair1), EMC (Ron Harley, Chair), PSRC- C17 (Dean Miller, Chair).

WG10: Generator On-Line Monitor, Izzy Kerszenbaum

The WG will have a draft report by next July. They will need to apply for a PAR.

Liaison reports

No report from El-Sharkawi on the Wind Coordinating Committee as they are meeting the following day.

Nilsson and Kersenbaum attended the PSDP Working Group on Dynamic Performance of Wind Power Generation Meeting. The scope of this WG is in line with the EMC activities. An active participation from EMC in this WG is needed. A report on this subject is attached.

Nilsson reported on the Liaison with the PSRC, a report is attached

Other Issue

Bill Bartley is requested to prepare a short presentation on the standards process for the GSC members next PES meeting.

IEEE PES EMC Nominated AWARD WINNERS

This posting lists Institute of Electrical and Electronics Engineers (IEEE) Power and Energy Society (PES) Electric Machinery Committee (EMC) winners of the EMC Distinguished Service Award, EMC Prize Paper Award and EMC Working Group Recognition Award by year for the last several years. These data used to be tracked by the IEEE Power Engineering Society Organization and Committee Directory in the 1970s, 1980s and 1990s and can be located in library copies of these directories.

EMC DISTINGUISHED SERVICE AWARD

Year	Winner
2010	Chuck Wilson
2009	Om Malik
2008	Azizur Rahman
2007	Isidor Kerszenbaum
2006	Osama Mohammed
2005	Lon Montgomery

EMC PRIZE PAPER AWARD

Year	Author(s)	Title
2010	Ray Bartnikas and Richard Morin	*Analysis of Multistress-Accelerated Aged Stator Bars Using a Three-Phase Test Arrangement*, Trans. on EC, Vol. 21, No. 1, pp. 162-170.
2009	Rene Wamkeue, Fred Baetscher and Innocent Kamwa	*Hybrid-State-Model-Based Time-Domain Identification of Synchronous Parameters from Saturated Load Rejection Test Records,* Trans. On EC, Vol. 23, No. 1, pp. 68-77.
2008	Haran Karmaker and Andrew Knight	*Investigarion and Simulation of Fields in Large Salient-Pole Synchronous Machines with Skewed Stator Slots,* T on EC, Vol. 20, No. 3 pp.604-610.
2007	Subhasis Nandi, Hamid Toliyat and	*Condition Monitoring and Fault Diagnosis of Electric Motors – A Review,* Trans. on EC, Vol.

	Xiaodong Li	20, No. 4, pp. 719-729.
2006	Johann Haldemann	*Transpositions in Stator Bars of Large Turbogenerators,* Trans. on EC, Vol. 19, No. 3, pp. 553-560.
2005	G. Kliman, S. Lee, M. Shah, M. Lusted, And K. Nair	*A New Method for Synchronous Generator Core Quality Evaluation,* Trans. on EC, Vol. 29, No. 3, pp. 576-582.

EMC WORKING GROUP RECOGNITION AWARD

Year	WG Chair	Title
2010	William Barley	IEEE Std. 1665, *Guide for the Rewind of Synchronous Generators 50 Hz and 60 Hz, Rated 1 MVA and Above.*
2008	Geoff Klempner	IEEE Std. 67-2005, *Guide for the Operation and Maintenance of Turbine Generators.*
2007	Jim Michalec	IEEE Std. C50.13-2005, *IEEE Standard for Cylindrical Rotor 50 Hz and 60 Hz Synchronous Machines Rated 10 MVA and Above.*
2006	Paul Dandeno	IEEE Std. 1110-2002, *Guide for Synchronous Generator Modeling Practices and Applications in Power System Stability Analysis.*

S U M M A R Y

PSDP Working Group in Dynamic Performance of Wind Power Generation Meeting

Minneapolis, Monday July 26, 2010

Report to the Wind Generator Subcommittee of the EMC

The meeting was called to order in the MCC Room M100D at 3 PM. The room had seating for 30 and 70 were in attendance. N. E. Nilsson and Dr. I. Kerzenbaum attended representing the EMC. The chair was Anthony Ellis who can be reached at aellis@sandia.gov. The following points were made:

- The transient models used for power system interaction analysis are designated as WT1, WT2, WT3 and WT4.
- The acceptability of the models depends on how well they can be ***validated***.
- ***Validation*** does not require an exact response.
- The WT1 model doesn't validate well at the present time.
- NERC standards require non-proprietary models.
- Controls are extremely non-linear and the performance of the machines is heavily dependent on limiters.

The Working Group (WG) has a paper in draft form that the WG is putting into final form for publication. After the meeting, I asked Anthony Ellis to send a copy of the draft paper to me and I will arrange comments from Dr. El-Sharkawi and the EMC. I also asked that Dr. El-Sharkawi be made a member of the WG.

N. E. Nilsson

August 1, 2010

JOINT WORKING GROUP ON FAULT CURRENT CONTRIBUTIONS

FROM WIND PLANTS

Transmission and Distribution Committee (T&DC): Reigh Walling, Chair1

Electric Machinery Committee (EMC): Ron Harley, Chair

Power System Relaying Committee (PSRC) C17: Dean Miller, Chair

Gene Henneberg, Vice Chair

MINUTES OF THE MEETING HELD

In Conjunction with the PES General Meeting

Room 205C

Minneapolis, Minnesota

Tuesday July 27, 2 – 5pm

Established: July 2008

Output: Report

Assignment: To characterize and quantify short circuit current contributions to faults from wind plants for the purposes of protective relaying and equipment rating, and to develop modeling and calculation guidelines for the same.

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1. Ron Harley Chaired the meeting, called it to order a 2:00 pm, and introduced the other Chairs, Reigh Walling who was also present, and Dean Miller who could not be present. Thirty persons attended. Ron reminded visitors of the assignment of this Joint Working Group (shown above for convenience) and summarized the progress since the first meeting in Atlanta in January 2009.

2. Michael Starke volunteered to keep minutes for the meeting.

3. Members and attendees of the Joint Working Group (JWG) meeting introduced themselves

4. The Agenda prepared by Dean Miller was approved.

5. The minutes of the previous meeting held on Tuesday January 13, 2010 in Orlando, were approved without any changes.

6. Charlie Henville presented a paper “Current Contribution from a Wind Plant for a System Fault” on behalf of Dean Miller. He discussed a model that was developed by Dean for a line-to-line fault on a line from a DFIG plant in Wyoming and how the data was applied. Dean’s measured results were close to the model results (RMS). During the discussion several points were raised:

a. Charlie noted that records were now becoming available on fault contributions from wind plants. Kaylyan Mustaphi volunteered to provide more waveforms and data.

b. Reigh Walling noted that from his modeling he would expect that the current peaks would actually increase during the first few cycles of a fault before decreasing. Moreover, the converter would typically turn the crowbar on and off during sub-cycles. In Dean's results it was not clear whether a crowbar was on or off.

c. Keith Harley asked what the fault impedance was and Charlie suggested that impedance in a line-to-line fault could be neglected as it was in the form of arc plasma.

d. Charlie mentioned a paper/presentation that had been provided during the morning elsewhere in the PES conference, relating to converter fault contributions where the authors pointed out that a 15% voltage drop would lead to their converter turning off due to the characteristics of the switches.

e. A question was raised on how fast the generator protection could be turned off/activated. It was stated that conventional protection could typically interrupt within 100 ms while an inverter could interrupt in a single cycle. Ron mentioned that understanding just these issues is what the working group was trying to accomplish.

f. Discussion moved to modeling the generator as a transient reactance for calculating sequence components of currents. However, this depends on whether the inverter is crowbarred or not. A typical value of 20-30% reactance is typically used for the transient reactance for crowbarred inverters when accurate machine data was not available.

7. Ron mentioned a paper "Short circuit current contribution for different wind turbine generator types", Ed Muljadi, Nader Samaan and others, that was being presented in another session during the exact time of the JWG meeting. Nader Samaan who attended the JWG meeting, agreed to give an impromptu summary of the Muljadi paper to the JWG meeting.

a. Nader discussed the Type 1 turbine fault contributions to different fault types. Travis asked what software was utilized to model these characteristics. Nader noted several packages were used for the different wind turbine types including Matlab, PSCAD, and DIgSILENT PowerFactory.

b. Nader moved to Type 2 turbines describing the effect of the rotor external resistor on fault current. Discussion moved to the waveforms and the magnitude of the DC component and whether it would cause interrupt problems.

c. Nader discussed Type 3 turbines and three-line to ground, line-line to ground, and single-line to ground fault waveforms. It was shown that Type 3 has similar behavior to Type s 1 and 2 if the crow-bar is activated. Reigh Walling asked whether the paper discussed the crowbar approach and all the types of crowbar controls. Ron questioned whether in general a d-q model of the induction generator is accurate enough to represent an unsymmetrical fault. Ron asked Reigh about typical stator winding configurations and the reply was that these tend to be delta or floating wye.

d. Nader moved to type 4 faults. He showed that the short circuit current is constant for different fault types with a magnitude of 1.1 pu with no decay. Questions were raised on the recovery period of the waveforms.

e. Ron invited Nader and the other authors to do a full presentation with answers to some of the questions at the next meeting of the JWG in January 2011 in Atlanta.

8. DRAFT REPORT.

Ron mentioned the working group's draft report that a number of persons were working on. The draft was not yet ready to be sent out to the working group members and the different sections written by different persons still have to be coordinated.

a. Travis Smith summarized what ORNL was doing in terms of modeling the machines. Reigh Walling noted that simplifications are often not a valid approach but a full scale time domain model is needed to be accurate. There is a need to examine all the software modeling approaches utilized and validate the models based on real data.

b. Charlie then discussed the section 6 that he wrote in the draft report. He discussed the list of questions he raised that a relay engineer needs to know.

c. Ernst Camm suggested that we should look at the big picture, and report on all the cases and scenarios without waiting to have a definitive answer on each at this point in time.

d. A question was raised whether ride-through was outside the scope of this JWG and most present agreed that it was.

e. Ernst asked whether we were trying to attempt too much for this JWG but none had a clear opinion.

f. It became clear that a core group of persons need to focus on editing and writing this first report. This group would have frequent conference calls and possibly webex meetings. Ron and Ernst would coordinate.

9. PLANS FOR THE NEXT YEAR

The meeting agreed to recommend that a panel session be planned for the next PES general meeting in July 2011 on "Fault current contributions from different types of wind plants". (This was approved at the Electric Machines Committee meeting the following day).

10. NEXT MEETING

The next meeting of the Joint Working Group will be in January 2011 in Atlanta. The C17 Working Group of PSRC has a meeting in Berkeley, California in September 13-16, but very few people present at the Minneapolis meeting would be able to attend the Berkeley meeting.

The meeting adjourned at 4:45 pm.

Respectfully submitted.

Ron Harley and Michael Starke

2010 LIAISON REPORT

To the Electric Machinery Committee

from the Power System Relay Committee

The Power System Relay Committee (PSRC) convenes three meetings a year away from the IEEE PES Annual Meeting during January, May and September. The most recent meeting was convened in Madison, Wisconsin, from May 10-13, 2010. The next meeting will be held in Berkley, California, from September 13-16, 2010. The main items of interest to the Electric Machinery Committee (EMC) are the activities of Subcommittee J: The Rotating Machinery Protection Subcommittee (RMPS). The PSRC Chair is Miriam Sanders. The RMPS Chair is K. Stephan and the Vice-Chair is M. Yalla. Working Group (WG) activity is as follows:

J1. The Adjustable Speed Drive Motor Protection WG and Protection Considerations for Combustion Gas Turbine Static Starting WG finished their assigned reports to committee which should be available on the PSRC web site at the time of the July 2010 EMC meeting. Both of the WGs will undertake a transactions paper on their respective topics as a follow-up action.

J3. The Protective Relaying for Pumped Storage Hydro Units is chaired by Joe Uchiyama. They discussed microprocessor based multifunction protection relay issues. Stator ground fault relay and electromechanical differential relay durability issues were also discussed.

J8. The Generator Tutorial Revision WG is chaired by Michael Thompson. It was established in 2007 and the output will be a Tutorial. The project will be performed in two steps. Draft 0.9 has been completed. The Tutorial will be ready by January of 2011 and presentation formats could include the following: PSRC Meeting, Regional Relay Conferences, PES General Meeting and Webinars among other things. A recommendation was made to issue CEUs.

J9. Jon Gardell chairs the Motor Bus Transfer WG. It was formed in 2006 and a report will be the WG product. Field testing and data acquisition have been changed from the TVA Para-dise Plant to the TECO Big Bend Station. The 1.33 per unit volts per hertz criteria of ANSI C50.41 may not guarantee a safe transfer. The WG discussed Draft 11 of the WG Report.

J10. Prem Kumar is the Chair of the revision of the Guide for AC Motor Protection, established in 2007. Revision of Draft 1 of C37.96 is in progress. Additions will include cross-refer-encing fault types with applicable protection functions. Coordination with WG J9 is required.

JTF3. Joe Uchiyama chairs the Power Plant and Transmission System Protection Coordination WG. The WG is working to specifically address issues from the 2003 Blackout. The NERC Technical Reference Document was discussed and its recommendations need to be included in the next revisions of C37.101, C37, 102 and C37. 106.

N. E. Nilsson, May 16, 2010