

**Date:** 2017/02/03

**Attendance:**

Nathan Bliesner  
Mohammed Almoneef  
Suliman Alrashidi  
Geoffrey Vonbargen  
Waleed Almotairi  
Dr. Herb Hess

**Business:**

Went over importance of an agenda. (Write agenda for every meeting - all members should participate)

Notebook for the group and one for each member.

Went over missing, required group members:

Wiki worker- Sam (Suliman)

Budget person (Geoffrey)

Leader to keep up with agenda. (To make sure that members follow each week's agenda)

Sam brought up software requirements:

Matlab-Simulink

Power World (19, full license)

Project (Define problems):

**We will make arrangements to visit downtown Spokane.** (2 generators, one is underground)

Task #1: Generator that has been mostly modeled. Finish modeling this first generator (lower falls):

Book by Bin wu has a very good generator model, subject of wind turbines

Alternatively the model in simulink

There are four wind turbines in the book, #4 in the book is synchronous machine generator

We have to put parameters in the sample from book ECE 427 Diff. Eq. form so we can put it in MATLAB/Simulink

Parameters can be obtained from last semester

Task #2: Is to do the same requirements above for generator #2, but:

We do not know the parameters of this generator

Must come up with some parameters and a way to prove this

(per unit is very similar across generators of similar size and type)

We do have some data off the nameplates, and will have full load operation information

The other team is working on the load and some other generation sources

Others on project are working on load shedding

Task #3:

Setting up a control system to control voltage and frequency

JJ has software installation specifics for Matlab-Simulink.

Jorden Scott and JJ can help us get into power world

Next Wednesday in the IRINC there is an AVISTA meeting at 11 am

One representative to avista meeting each week.

**Date:** 2017/02/10

**Attendance:**

Nathan Bliesner  
Suliman Alrashidi  
Geoffrey Vonbargen  
Waleed Almotairi  
Dr. Herb Hess  
Jordan Scott

**Business:**

Went over the contract.

No need for an agreement with Avista. (Specifications are not going to be changed)

Dr. Hess and Scott will try to get the files of Simulink model for both generators from previous team.

**Project (Define problems):**

Water flows-in to turn machine; thus generating power. (Power is the product of Pressure and Flow).

Pressure is known (fixed), but flow can be changed to control the power

To control speed and frequency, flow or load can be varied/changed.

Task #1: G1

- Modeling the first generator, G1 (Use Simulink library to find the proper model)
- Use a form of differential equations (Specify input, parameters and output)
- Build the circuit after writing the differential equations

ECE427: HW#1: Problem 2 for the multiple 1st order differential equations.

2 in-class examples for both 2nd and 3rd orders differential equations.

Task #2: G2

- Same requirements for 'Task #1
- Test to make sure that the second generator, G2, has the right model (Avista question!)

Task #3: Frequency Control

- Change load/flow to control both speed and frequency. Also, the main controller for frequency is "Water Flow"

Task #4: Voltage Control

- $E = k \phi \omega$

**Important tools and dates:**

Talk to JJ to get the research version for Simulink. (Libraries are only available on this version) JJ is in charge of the three licenses available. But two are already given out. Lexi and Len have access to one of the versions in the Micron Room. And Jordan Scott has access to the other on his personal PC.

Talk to Stephanie to get a key and/or a vandal card access to the power lab. (GJ 102B)

Talk to Brian Johnson's grad students to get Pavan's files for the PowerWorld model.

Avista meeting is on Wednesday (Feb 22, 2017). (Prepare questions)

Snapshot day is on the week right before Spring break.

2017/02/17

**Attendance:**

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Waleed Almotairi  
Dr. Herb Hess  
Jordan Scott

**Minutes**

***Important Notes:***

· Dr. Hess will send out today the previous group work. Also Jordan Scott got some additional files from old group

· For Matlab Simulink, the libraries that we need:

1- Control System 2- Signal Processor 3-Sem Power System

Note: VPN will help with the access, so everyone should try to contact help desk for VPN issues.

Ø Where do we start?

Modeling for sync. Machine; give it 3 Phase voltage source, single phase (DC) . Then put load instead of source. Set KVA on that voltage to get a function in a very simple bases. Finally, see what parameters will do for us.

Ø Models:

- Convert the model to W/U book model, then check results
- Change load in case
- Figure out steady state data. Also transfer data.
- As we know, when load change the frequency either increase or drop.
- The way to reverse; get system data and put it in Power world
- Frequency gets done by small power system, so should look at microgrid stuff to know more

***Important Dates:***

- Avista Presentation is on Wednesday 02/22/2017 at 3:30 PM (IRIC 321)
- We should organize a tour to Spokane within next 2 weeks

**Date:** 2017/02/24

**Attendance:**

Nathan Bliesner  
Mohanned Almoneef  
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Geoffrey Vonbargen  
Waleed Almotairi  
Dr. Herb Hess

**Group Split**

Governor (Nathan, Geoffrey)

Excitor (Mohanned, Suliman)

Per Unit Measurements (Waleed)

Do internal components instead?

- The internal components of the modeling will be the more difficult task.
- This will be a design with incomplete information.

Exciter

- Find a data sheet for old exciter from 1922 and older.
- A DC model can possibly be used for the exciter

Governor

- Find out if the machine has one or not.

General Machine

- 3 Time constants, compare numbers of several machines to get a common value
- Machine in lab maybe a value source
  - Machine is about 80 years old
  - Compare data from this machine to find characteristics that can be used
- Most machines are significantly under damped
- The Wu book will have a lot of those values
- Talk to Avista about getting event data
  - This will help identify those values.

**Preparation for Snapshot**

- Should have a decent model without the numbers
- Define what the project is

**Avista's Tour**

- Jordan Scott can help make arrangements
- Tour the two generators (Monroe and Post) and also the substation that connects them.
- Have questions available for Avista about the generators
  - Have Dr. Hess Review before

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Dr. Herb Hess  
Jordan Scott

**Models:**

- The governor we found is a PID controller
  - This may not be what is in place in Spokane.
- Post Generator has a DC exciter
- Monroe Generator has a solid state exciter
- Exciters will have similar topologies
- Put machines in per unit to compare
- Find impedances that fit close to the machines
- The smaller the machine the greater the pu impedances
- Per unit works well with frequency/voltage/ current
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**IEEE 115 Standard:**

- Shows how to find parameters from transients

**D and Q axis**

- Model must have D and offset if we expect it to work at all.
- $E = \omega LI$
- D axis points in direct of magnetic field and rotor
- Q axis points in direction of Voltage (electric field)

**Standard Model:**

- Wait to use as a last resort

**Synchronous Model:**

- 100 RPM are typically salient
- Higher RPM is steam base generators
- Slower speed is better for our models

**GentPJ Model:**

- Build this model and get up and running
- Use this model to test for parameters for the synchronous machine model.

**Avista Tour:**

- Schedule will be around Avista
- March 30th is the date Avista responded with for tour
- Later date would give us time to develop better questions for Avista
- Set the restriction of Thursday for tour with Avista could open that up for an earlier date

**Why Matlab?:**

- Easier to change values
- Has the dynamics for the machines
- Easy to test for various components

**Snapshot/Expo:**

- See about setting up next to other Microgrid group "Smart Spokane"

**Date:** 2017/03/10

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Waleed Almotairi  
Dr. Herb Hess  
Jordan Scott

- Reviewed previous minutes
  - Make sure to keep track of action items
- Wednesday March 22, 2017 at 10AM someone needs to be in the meeting room with Avista
  - Need to send Jordan a message of what we have accomplished the last couple weeks
    - The Monday before
    - Must have name of presenter
  - Basicly reporting to Avista
  - Takes between 3 to 15 minutes
- Randy and Caitlin are our contacts from Avista
- Avista trip
  - March 30, 2017 at 10AM arrival time. 8AM departure time
  - Geoffrey will do van stuff on Monday (Check paperwork for vehicle)
- Event data from Avista
  - Power quality meter:
    - Takes readings of voltage and current waveforms; concentrates on transients Records these transients or sags/swells (10% off norm).
    - Basically detects unusual changes and records them
    - Measurements should be close to generator
      - Start from generator, to lines, to first transformer (find first customer) and then plug power quality meter on the back corner (wall), and then estimate impedance and refer back to generator
- Prepare 20 questions
  - Questions must be first reviewed by Dr. Hess and Jordan Scott (send by e-mail)
    - Note: During tour you can ask any question! (in person)

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**Action Items**

- Geoffrey take care of van rental
- Need to email Avista through Jordan cc Hess
  - Power quality meter if possible
  - Voltage current waveforms off Post and Monroe St. generators
- Work on models

**Date:** 2017/03/24

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Waleed Almotairi  
Dr. Herb Hess  
Jordan Scott

- Not just writing questions to Avista, you can also come up with some questions during the tour
- Van is reserved for Wednesday, March 30th, 2017
  - Meeting at 7:45AM in the Power Lab. Leaving at 7:55AM
  - Arrive at 10:00AM in Spokane
  - Take some money just in case! (Bring receipt for one lunch, food might also be provided by Avista), also, bring receipt for the gas whenever you fill the van
  - Must wear long pants, closed toes (No sandals). No long hair
- Steps for the tour to Spokane:
  1. Meeting will be on Monroe/Post St.
  2. Substation (Several hours)
  3. Break for lunch
  4. Have a discussion with the sponsor
  5. Go back to Moscow
- Phone: Write a one page document and send it to Avista (Every while)
- Important things to do during the tour to Spokane:
  - Look at rated machines
  - What kind of turbine?
  - MVA rating, voltage rating
- Gtntpj model (Divide by zero!) Transient parameter is 5, should be bigger than 0.3 subtransient
- Simulink library's model, current and speed graphs look good, but voltages don't
- Design review:
  - Define problem, how to solve it, steps, procedure
  - Outline presentation (PowerPoint, but not only that!)
  - What we have done to solve problems? Prove with graphs, parameters and equations
  - Format for simulations
  - Status? Where we are? When and how to accomplish the whole project?

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**Action Items:**

- Mohanned will take care of the IRIC room reservation for the Fall semester
- During the tour: Look at rated machines, What kind of turbine?, MVA rating and voltage rating
- Work on models
- Find transient parameters

**Date:** 2017/03/31

**Attendance:**

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Geoffrey VonBargen  
Suliman Alrashidi  
Waleed Almotairi  
Dr. Herb Hess

- Task 1: Review Previous Minutes
  - There are no objection on the previous minutes.
  
- Task 2: Avista Tour Update
  - The digital exciter will work on our system.
  - Dr. Hess suggested to take a picture from simulink and powerworld for the parameters that we need.
    - Excitation system
    - Governor system
  - (Average time constant, Single time constant) ASK DR.JOHNSON ABOUT IT
  - Will work on RTDS program. ASK DR.JOHNSON ABOUT IT
  - Read ECE 422 book to find about the transient.
  - Review the types for the Excitation system, and Governor system we found out in the trip.
    - Excitation system: SILCO 5 “Lower falls”
    - Excitation system: STATIC “upper falls”
  
- Task 3: Progress Update
  - Simulink Model:
    - We removed the transformer from the model as Dr.Hess suggested.
    - We increased the inductance in order to improve the Vf(Field voltage) graph. And no much improvement so far.
  
- Task 4: Frequency and Voltage Regulation
  - Both the Excitation system and the Governor system there main job is to control the frequency and the voltage

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**Action Items:**

- Schedule a time for the Design review.
- Select the parameters needed to be send to Randy. “Review them with Dr.Hess, Jordan Scott”



**Date:** 2017/04/07

**Attendance:**

Jordan Scott  
Nathan Bliesner  
Mohanned Almoneef  
Geoffrey VonBargen  
Suliman Alrashidi  
Waleed Almotairi

- Task 1: Review Previous Minutes
  - There was no objection
  
- Task 2: Long Lake Generator
  - We should remind Jordan Scott to help us complete this task
  
- Task 3: Progress Update
  - Simulink Model:
    - We should double check that; Silicon 5 is an interface, so it may not be the name of the model.
    - We should know the real excitation system model inside the excitation that we saw at the Two generators.
    - We increased the inductance in order to improve the Vf(Field voltage) graph. And no much improvement so far.
  
- Task 4: Steady State
  - Jordan Scott will reserve at least an hour with Randy to finish this task
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- Task 5: RTDS (At least Two people start learning RTDS with Jordan Scott for future tasks)

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**Action Items:**

- Jordan Scott will reserve at least an hour with Randy to finish Steady State task