

Attendees: Kayden Chad Hatem Majed, Dr. Li

Action Items For Review: (15 min)

AI:21 Chad

Build a unit for synchronizing the power system in the advanced power lab to the Avista system. This action item is going to change to configuring a SEL-351 so that it can be used to synchronize the system. I plan to get a copy of the 351 documentation at work. (10/16)
Due 3/15

AI:26 Kayden Due 11/20

Kayden will talk to JJ about installing WEBEX software for "all users" onto the conference room computer for meetings with Stephanie. 10/30 In progress.

AI:27 Kayden Due 11/11

Figure out how to print the Gantt chart for the next meeting with Stephanie. 10/30 Still need to figure out how to print only the Gantt chart. 11/06 Still in progress. 11/19 still in progress

AI:31 Chad Vorse 11/2 **No started, in progress. Done - not needed.**

Review the motors textbook to assist with understanding the test we are doing from the IEEE standard and any workarounds that will be needed in the lab. Update: I have started reviewing the textbook, especially on the slip questions that came up during the design review. I still need to work on understanding the motor tests we are doing and how the IEEE test will be modified since we cannot supply a voltage higher than 240V to the VFD.

AI:37 Everyone Due 12/3 **Done**

Review the parameters of the VFD to determine if there is any opportunity to enter characterized values from the motor work into the VFD. **12/3, done. The VFD does not have parameters that we can edit directly. Two emails were sent out as a follow up to this action item. They are included for reference here:**

There are two important updates I would like to send out to everyone.

1. The VFD does not have parameters that can be modified by the user specific to motor characteristics like stator resistance, stator inductance, rotor inductance, etc.
2. The VFD does have the ability to receive feedback directly from an encoder, but not the one we have.
 - a. The encoder has to be a pulse style encoder with an A and B pulse. A leading or lagging B would indicate direction. The VFD also has support for a Z pulse (zero pulse).
 - b. We do not have this type of encoder. The encoder we have provides a 13 bit binary value indicating the rotors absolute position. The VFD cannot decode our encoder signal.

Feel free to send me any questions you may regarding these updates

We know from the description in the figure below that the VFD parameterizes the motor in two possible times, both of which are mutually exclusive from one another. The ID run is described as “a self-calibration process... the drive operates the motor (motor rotating) and makes measurements in order to identify motor characteristics and create a model used for internal calculations.” The ID run actually turns the motor during its calculations. A bit further down, it mentions the “Identification magnetization is performed, depending on parameters 9904 and 2101... the motor model is calculated at first start by magnetizing the motor for 10 to 15 s at zero speed (motor not rotating). The model is recalculated always at start after motor parameter changes.”

Note that the description states “if motor parameters are changed after the ID Run, repeat the ID Run”.

The motor parameters are listed as follows:

2601: FLUX OPT ENABLE – changes the magnitude of the flux depending on the actual load.

2602: FLUX BRAKING – Provides faster deceleration by raising the level of magnetization in the motor when needed

2603: IR COMP VOLT – Sets the IR compensation voltage used for 0 Hz.

2604: IR COMP FREQ – Sets the frequency at which IR compensation is 0 V (in % of motor frequency)

2605: U/F RATIO – Selects the form of the U/f (voltage to frequency) ratio below field weakening point (linear or squared)

2606: SWITCHING FREQ – Sets the switching frequency for the drive (default is 4kHz).

2607: SWITCH FREQ CTRL – The switching frequency may be reduced if the VFD internal temperature rises above a limit.

2608: SLIP COMP RATIO – Sets gain for slip compensation (in %).

2609: NOISE SMOOTHING – This parameter introduces a random component to the switching frequency.

2619: DC STABILIZER – Enables or disables the DC voltage stabilizer.

I do not know if this is all inclusive, or if we even have access to all the parameters that are calculated. I had considered recording all the parameters, running the ID RUN, then checking to see what the machine changed. Still, a thorough review of all parameters available only reveals parameters like accelerations, decelerations, curve shapes (linear or s), and so forth. There are no parameters (other than name plate values) that are named after specific motor characteristics.

AI:38 Everyone 11/19 Done

Ask Mike West about how he set up the VFD parameters in the beginning. Mike didn't do any improvements to VFD parameters beyond entering the nameplate values. He specifically did not do an ID RUN.

New Agenda Items

Review goals for lab on Sunday Evening:

Chad

- My goal is to publish mechanical RPM and Slip by the end of the weekend, 11/22
 - I have successfully interacted with the encoder and read information coming back.
- I also plan to have a modified motor test for the no-load test and assist Hatem and Majed in conducting the test if they are in this weekend.

Majed

- Conduct one of the tests, it has not been picked yet
 - Windage loss, friction loss, $I^2 R$ losses and ID Run
- Hoping to get the hardest one out of the way
- Work on the RSCAD tutorial
 - We started the tutorial on RSCAD and made some good progress on learning that.
 - Started friction and windage losses test and the supply voltages are not sufficient. Dr. Hess has been asked for advice, still awaiting a response. Maybe Dr. Johnson would have ideas as well.
 - Majed has stated that he and Hatem will be working through the rest of the tutorial in RSCAD.
 - Completing the no load test

Hatem

- Hook the load bank directly to the machine
 - Hooked the load bank up to the Model Power System
 - Andy went over the connection to the model power system, the load bank connections, and RSCAD tutorial/documentation.
 - Determining the time constant of the system, we need to learn how to test for this.

Kayden

- Put on paper the connections to the VFD and the board. Create a list of registers that would be nice to see written to. (Change reference or increase/decrease speed).
- Mostly planning research, probably not too much hands on.
 - Kayden worked on researching the communication protocol.
 - The protocol is MODBUS and Kayden has worked with that at work. (Good news for us).
 - Set up a test and development environment at home.
- Kayden will be out of town for the holidays. He is hoping to finish his MODBUS driver over the break and then write the first parameters when he gets back.

New Minutes

New list of questions:

Dr. Fischer stated in the design review that it was not important to have lightening fast response to changes in frequency. Furthermore, he said we want the system to replicate the response of prime movers in the power industry. Two examples were a steam turbine and a hydro-powered turbine.

- It feels like we have had another large shift in the paradigm of our goals. We have consistently used the terms "fast as possible" and "small as possible" in our documents that have been reviewed by our technical advisors, but now it sounds like neither of these are true.
- Dr. Fischer specifically said "The VFD is capable of responding instantly. We do not want that... we do not want the VFD in the RTDS model."

Two reasons to characterize the machine. The parameters of the machine can be entered into the drive to tune the drive.

It is also worth have a simple model of the machine and the drive in the RTDS. The dynamics of the drive may not be very noticeable since the machine will be responding so much faster than the prime movers in the final model.

Dr. Johnson provides a book that has models within it. They are block diagrams but they have to have parameters added to it.

Dr. Johnson has the report and some other material for the power grid design team from a couple of years ago. He is going to provide this information to us.

Hatem asks about the time delay. The block diagrams are similar to what you have seen in signals courses. Our job is filling in the information for the block diagrams.

Kayden asked about who Doug Taylor is. He is an SEL engineering that relocated to Spokane.

Minutes, raw form...

AI: Invite Stephanie, Normann, etc. for the snapshot meeting.

AI: Send slide to Kayden for the snapshot meeting.

1/23/16

Byte-Back Team Agenda / Minutes

AI: Team will meet at the lab at 8:30 in the morning.
Dr. Johnson and Dr. Hess will be available on Monday.

AI:38 Chad Vorse

Re-write the specification and project description. Have Dr. Fischer review it in person.

AI:39 Kayden

Conduct a pseudo WEBEX meeting to make sure it is working.

Update from Chad: Dr. Hess suggested using a double inverter and mosfet to change voltage levels.

Majed: Two graduate students offered to help, but said it would take two months. They are going to have to start working on RTDS tutorials. Run a simulation from a prior year senior design team.

Hatem: Get draft reviewed by Dr. Johnson. Talk to Alap about RTDS.

Chad: Use SPI to read encoder. Isolate encoder and microprocessor voltages. Provide position and radial frequency to the PID algorithm.

Kayden: Edit the driver to be MODBUS compliant. (Google a modbus driver for the pic).
Complete an initial communication with the VFD.

We will talk about the design review next Thursday.

1/23/16

Byte-Back Team Agenda / Minutes