

RTDS Training course of IEPG

DAY [?]: Modelling Distribution Systems

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1.0 Preamble

The penetration of distributed generation resources like PV solar, wind turbines, fuel cells, and energy storage technologies is increasing in power systems as efforts to reduce impact of climate change, intensify. This lab introduces the Distribution Mode feature in RSCAD. The feature enables the creation of distribution feeder models with hundreds to thousands of nodes. The lab is based on the IEEE 34 bus system.

2.0 Lab Objectives

The tutorial aims to equip students with the basic knowledge to enable them do the following:

- a. Create a distribution system in RSCAD.
- b. Run basic simulations in Distribution mode.

3.0 Prerequisites

Before attending this lab session, students should:

- Be able to launch RSCAD and create a draft. (Module 1 and Module 2)
- Be able to do basic simulations in RSCAD. (Module 2)

4.0 Attached documents:

- Distribution Mode Draft file: Open RSCAD >> Tutorial >> Samples >> Distribution Mode Case >> IEEE34_nowind_DistributionMode.dft
- Distribution Mode Runtime file: Open RSCAD >> Tutorial >> Samples >> Distribution Mode Case >> IEEE34_nowind_DistributionMode.sib

The lab tutorial is in two parts, each focussing on one course objective outlined under “Lab Objectives”.

5.0 Creating a distribution case

The process for building a distribution case is similar to that for creating a standard DRAFT case in RSCAD. In this part the distribution mode is introduced in addition to a review of a sample case in RSCAD.

Step 1- Launch Distribution mode

Launch RSCAD's Draft module by clicking on "Draft" button as shown below in Figure 1. Select

"New distribution case" option and click OK.

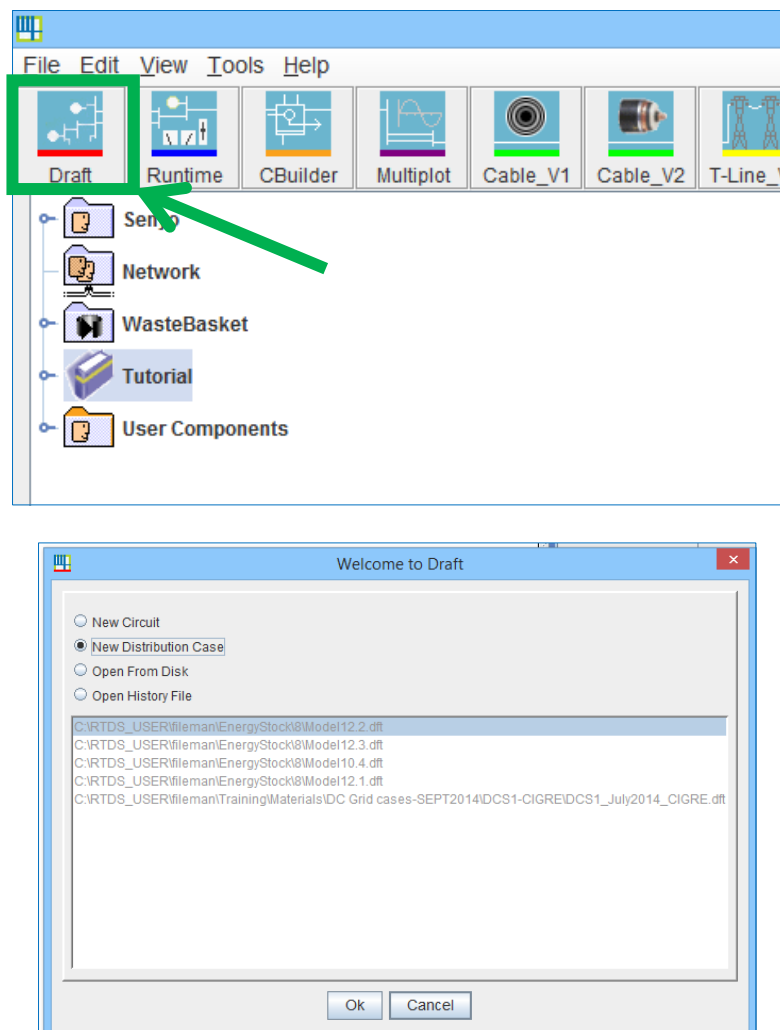


Figure 1: Draft button

Step 2-Create distribution system draft

The empty canvas which appears is the platform on which a new case can be created using library components shown in Figure 2. The distribution library has four tabs containing protection and automation, power system, controls and stretchable components. It must be

noted that the Distribution Mode library does not have the full set of components in the standard mode library.

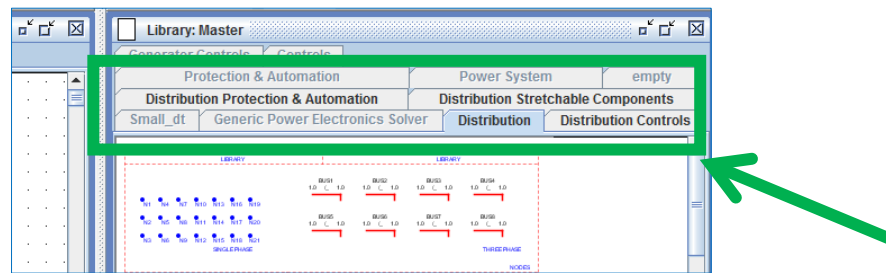


Figure 2: Distribution Mode Library

To study distribution mode further a built in sample case based on the IEEE 34 bus system will be utilised. The sample case can be found as shown in Figure 3. Load the sample file by double-clicking on the draft file.

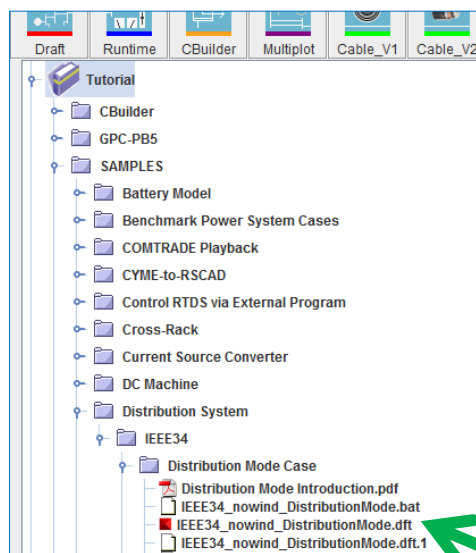


Figure 3: IEEE 34 bus sample draft file

Note: All Distribution Mode cases must be run on one rack and cannot be connected to standard mode circuits in any way. Minimum requirements to run distribution mode are as follows:

1. RSCAD software V5.00
2. PB5 Firmware version 25
3. GTWIF OS Version 4.105 Build 6
4. GTWIF FPGA Version 8082

The distribution system which appears comprises a source, buses, lines and distributed loads and meters. In order to know more about each component in the system, highlight the component with the mouse and press “H” on the keyboard to activate the help file. The pdf file will be automatically opened using the installed pdf reader (e.g. Adobe).

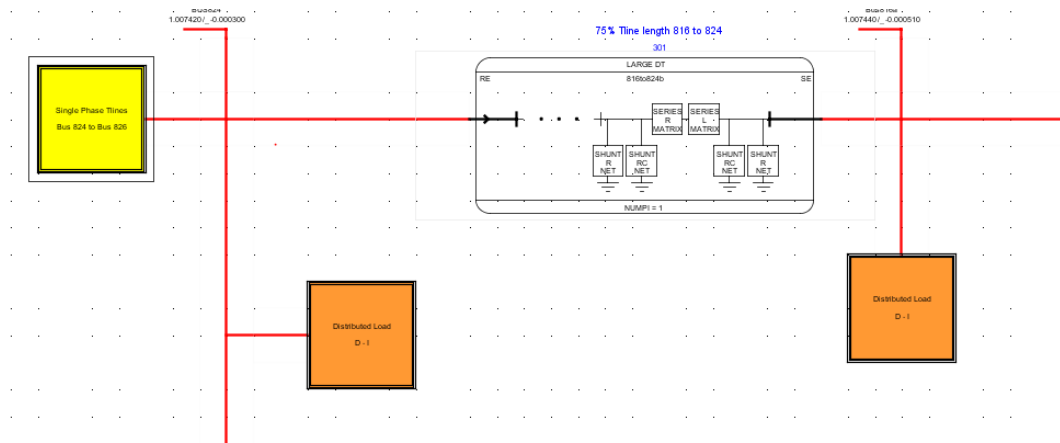


Figure 4: Section of IEEE 34 bus system showing bus 824 and 816 with connected loads

Assignment:

1. Open each load hierarchy box and check the components within
2. Double click on the lines to view the line parameters

6.0 Running a simulation in Distribution Mode

This section introduces the basics of running a real-time simulation of a distribution system. In order to view the electrical quantities in the distribution network in real time the runtime file has to be activated. The sample runtime file for the IEEE 34 bus system can be found in the SAMPLE folder as shown in Figure 5. First compile the draft and then double-click on the file to activate the runtime file.

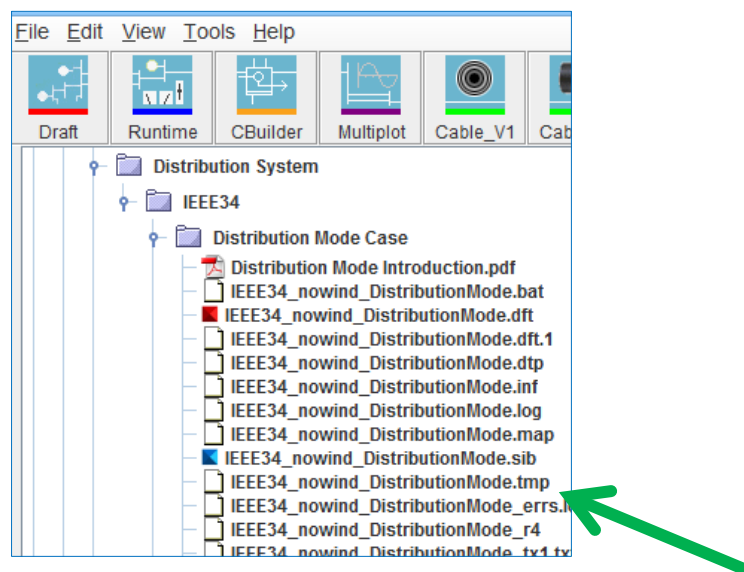


Figure 5: IEEE 34 bus sample runtime file

Note: The time step for distribution mode is between 150 to 200 microseconds (Generally, RTDS uses a large time step of 50 μ s).

The runtime file opens the screen shown below. To observe the bus voltages and make changes to slider settings, double click on one of the icons as shown in Figure 6 below to launch the graphs and slider.

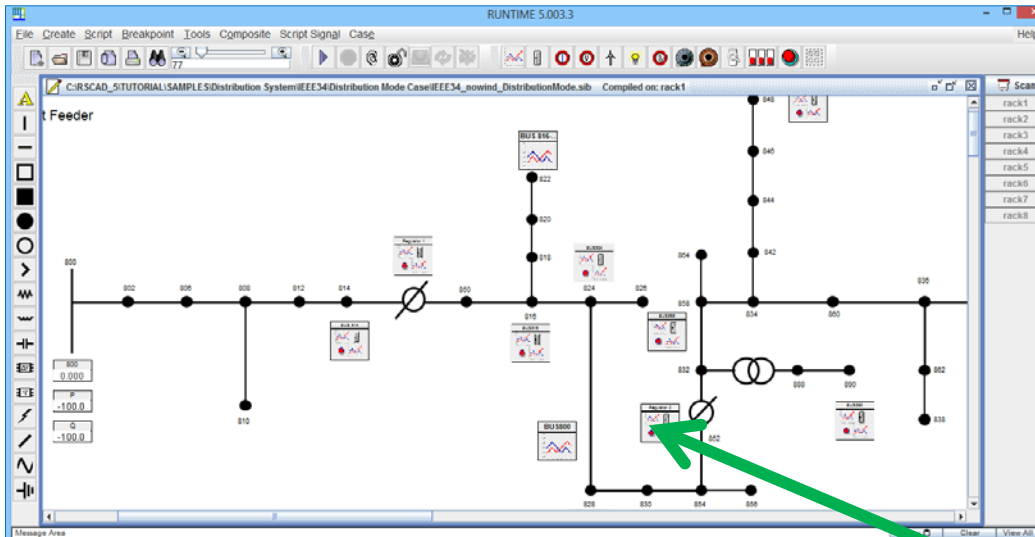


Figure 6: Runtime Simulation

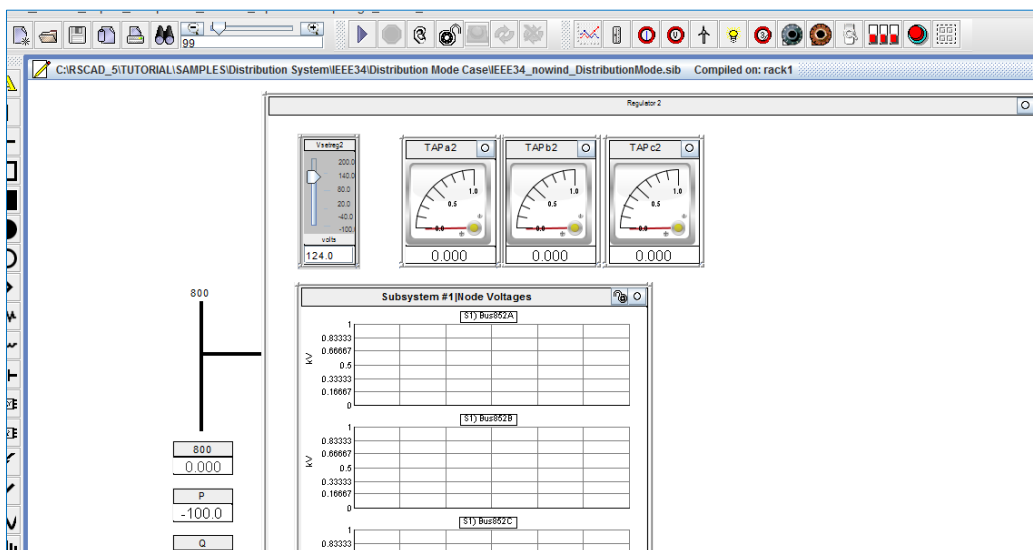


Figure 7: Bus voltages

Assignment:

1. Vary the slider settings and observe the impact on the bus voltages