**Seminar2**

This seminar consists of 2 parts. Both part1 and part2 involve simulations and it is recommended to work with Simulink. (PSIM, Saber or other software could be alternative options)

For both part1 and part2, AC side three-phase voltage source has the following specifications:

**RMS Value of Phase-To-AC-Neutral-Point Voltage: 220V**

**(i.e. RMS Value of Line-To-Line Voltage: 380V)**

**Line Frequency: 50Hz**

**PART1 Three-Phase Full Bridge Rectifier (Thyristor)**

 

Fig.1(a) Rectification Mode 1(b) Active Inversion Mode

In this part, the simulation is based on three-phase full bridge rectifier (thyristor version) with inductive load. Each group will be assigned with a set of parameters (L,R,E) as well as phase-shifting angle **α** based on which you are required to:

1. Carry out simulations and analyze:

* Whether the system works under Rectification Mode (AC/DC)

**OR** Active Inversion Mode (DC/AC)

* The sequence of driving signal of each thyristor
* The ON and OFF state of each thyristor

1. Do theoretical calculations of:

* Average value of DC-link voltage Vd
* Average value of DC-link current Id
* RMS value of AC side current
* RMS value of the current flowing through a Thyristor

1. Compare your theoretical results with simulation results and give necessary comments.

**PART2 Three-Phase Full Bridge Rectifier (Power Diode)**



Fig2. Diode Bridge with Capacitive Load

In this part, the simulation is based on three-phase full bridge rectifier (diode version) with capacitive load. Each group will be assigned with different capacitance for dc side capacitor. It is required to carry out simulation and analyze how the variations of load resistor RL would influence the following items:

* Output voltage
* Power factor
* THD

Then you should provide the following plots:

* Vo = f(RL)
* PF = f(RL)
* THD = f(RL)

(Hint1: One possible solution is that you choose 10 typical value for RL and get the corresponding steady-state value for Vo, PF and THD with Simulink. Then you store the data in corresponding vectors and later plot them in MATLAB. It would be better if you could find a more systematic way, e.g. by using scripting languages.

Hint2: Adding a small inner impedance to the grid side will improve your simulation waveform.)

**Appendix**

|  |  |  |  |  |  |  |
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| Group No. | PART 1 | | | | | PART 2 |
| **L** | **R** | **E** | **α1** | **α2** | **C** |
| **1** | 10mH | 1Ω | -500V | 60° | 150° | 8mF |
| **2** | 2mH | 10Ω | -540V | 30° | 120° | 7.5mF |
| **3** | 5mH | 5Ω | -510V | 40° | 150° | 7mF |
| **4** | 1mH | 5Ω | -500V | 50° | 140° | 6.5mF |
| **5** | 5mH | 1Ω | -450V | 80° | 160° | 6mF |
| **6** | 5mH | 1Ω | -400V | 85° | 170° | 5.5mF |
| **7** | 2mH | 1Ω | -480V | 70° | 110° | 5mF |
| **8** | 1mH | 10Ω | -400V | 0° | 100° | 4.5mF |
| **9** | 3mH | 5Ω | -350V | 20° | 90° | 4mF |
| **10** | 3mH | 15Ω | -600V | 10° | 178° | 3.5mF |