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LOAD FLOW ANALYSIS FOR THREE PHASE BALANCED DISTRIBUTION FEEDER USING MATLAB

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Abstract: In the present study, the results of a cold hot water dispenser with a thermoelectric module system (TMS) are presented. The cold hot water dispenser with a thermoelectric module system consists of a cold-water loop, a hot water loop, a coolant loop, and a thermoelectric module. The thermoelectric cooling and heating modules consist of four and two water blocks, nine and three thermoelectric plates, respectively. The cooling and heating capacities obtained from the cold-hot water dispenser with TMS are compared with those from a conventional cold-hot water dispenser with a compression refrigeration system (CRS). As compared with the conventional cold-hot water dispenser with CRS, the cold-hot water dispenser with TMS can be operated at the minimum cold-water temperature of 10 to 13°C and the maximum hot water temperature of 65°C. The obtained results are expected to provide guidelines to design cold-hot water dispensers with TMS.

***Index Terms* – Thermoelectric, Loop, Compression Refrigeration System (CRS)**

I. INTRODUCTION

The electrical power system is one of the most complex system types built by engineers Traditionally, electricity was generated by a small number of large bulk power plants that use coal, oil, or nuclear fission and was delivered to consumers through the power system in a one-way direction. Due to the modernization of the existing grid, a large number of new grid elements and functions including smart meters, smart appliances, renewable energy resources, and storage devices are being integrated into the grid. Thus, the existing electrical grid is changing rapidly and becoming more and more complex to control. A smart grid (SG) is offered as the solution to this problem. In a smart grid, most of the new grid elements are directly connected to the distribution network which requires new types of operation and maintenance. The distribution network has been considered as a passive network that totally depends on the transmission network for control and regulation of system parameters. Conventionally, the power flow in the distribution system was one-way traffic (vertical) from the substation (only source) to the end of the feeders. However, the utilization of distributed generation (DG) made the distribution network active in the sense that the distribution network can generate electrical power in the network and transfer the extra power to the transmission network. This changes the direction of the power flow in networks into two-way traffic (horizontal). Therefore, central grid operators or transmission system operators (TSOs) of the power system must have different approaches for maintaining and operating the electrical grid because in this case, the main purpose of the operator has been adjusted to interconnect the various active distribution networks.

II. WORKING

The test system consists of two fully symmetrical areas linked together by two 230 kV lines of 220 km length. It was specifically designed into study low frequency electromechanical oscillations in large interconnected power systems. Despite its small size, it mimics very closely the behavior of typical systems in actual operation. Each area is equipped with two identical round rotor generators rated 20 kV/900 MVA. The synchronous machines have identical parameters except for inertias which are H = 6.5s in area 1 and H = 6.175s in area 2 . Thermal plants having identical speed regulators are further assumed at all locations, in addition to fast static exciters with a 200 gain.The load is represented as constant impedances and split between the areas in such a way that area 1 is exporting 413MW to area 2. Since the surge impedance loading of a single line is about 140 MW, the system is somewhat stressed, even in steady-state. The reference load-flow with M2 considered the slack machine is such that all generators are producing about 700 MW each. The results can be seen by opening the Power-gui and selecting Machine Initialization. They are slightly different from, because the load voltage profile was improved (made closer to unity) by installing 187 Mvar more capacitors in each area. In addition, transmission and generation losses may vary depending on the detail level in line and generator representation.

III. SIMULINK MODEL AND RESULT

For an initial understanding of the network behavior, we can simulate its open-loop responses (PSSmodel = 0) to a 5%-magnitude pulse, applied for 12 cycles at the voltage reference of M1. This test is activated by opening the timer controlling the voltage reference of M1 and changing the multiplication factor of the transition times vector from 100 to 1. Similarly, the line fault should be deactivated by changing from 1 to 100 the multiplication factor of the transition times vector in the "Fault" device and line breakers "Brk1" and "Brk2". After starting the simulation, the signals responses are visualized by opening the "Machine" and "System" scopes on the main diagram. All signals show undamped oscillations leading to unstability. A modal analysis of acceleration powers of the four machines shows three dominant modes:

- (1) An interarea-mode (fn = 0.64Hz , z = -0.026) involving the whole area 1 against area 2: this mode is clearly observable in the tie-line power displayed in "System" scope
- (2) Local mode of area 1 (fn = 1.12Hz, z = 0.08) involving this area's machines against each other
- (3) Local mode of area 2 (fn = 1.16Hz, z = 0.08) involving machine M3 against M4 (i.e.: the smaller the inertia, the greater the local natural frequency)

If one of the two tie-lines is removed by setting the breakers "Brk1" and "Brk2" in an open position, it is possible to achieve another steady-state stable equilibrium point with the same generation and load patterns. This is called a post-contingency network, easy to initialize using the Machine Initialization tool of the Powergui. A modal analysis of this network's responses to the same 5%-magnitude pulse, applied for 12 cycles at the voltage reference of M1 reveals that, while the two local modes remain basically unchanged in both frequency and damping (fn=1.10Hz, z=0.09 in area 1 and fn=1.15Hz, z=0.08 in area 2), the interarea mode shifts to a much lower frequency with still a negative damping (i.e.: unstable): (fn = 0.44Hz, z = -0.015).

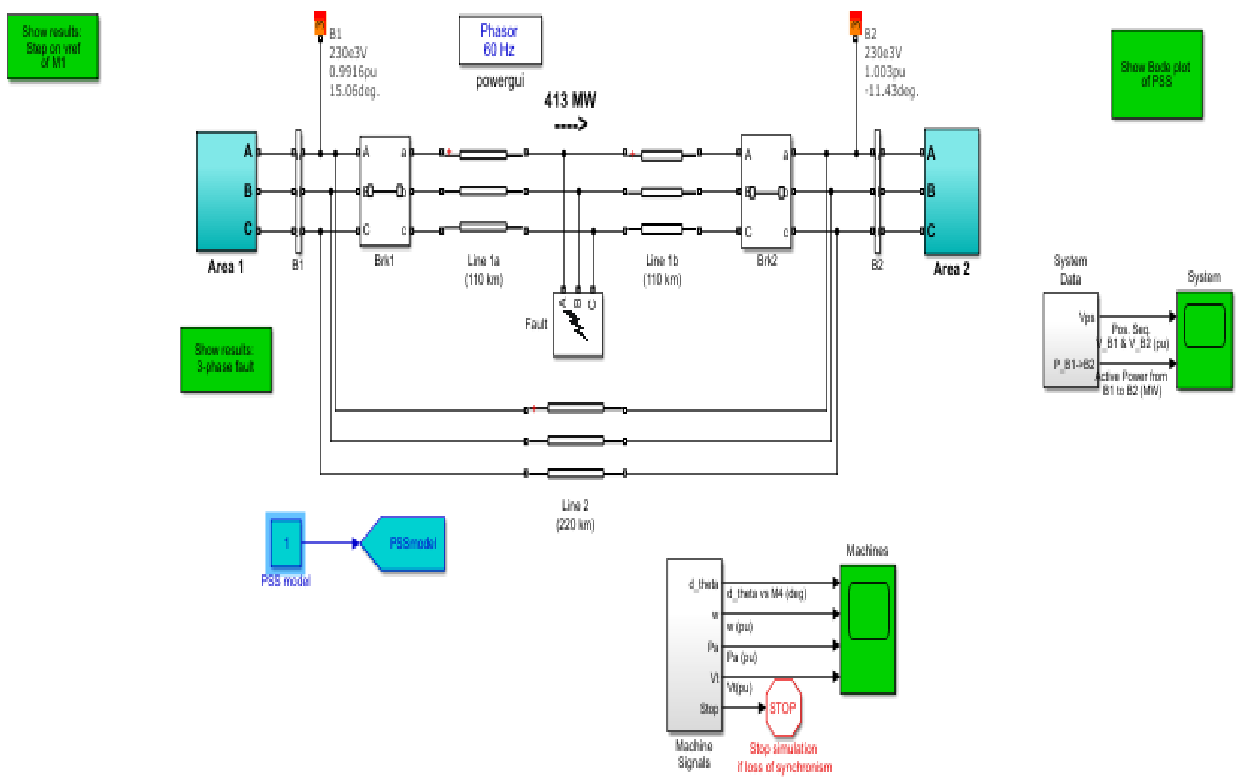

Figure 3.1:- SImulik Model of Three-phase distribution feeder line load flow

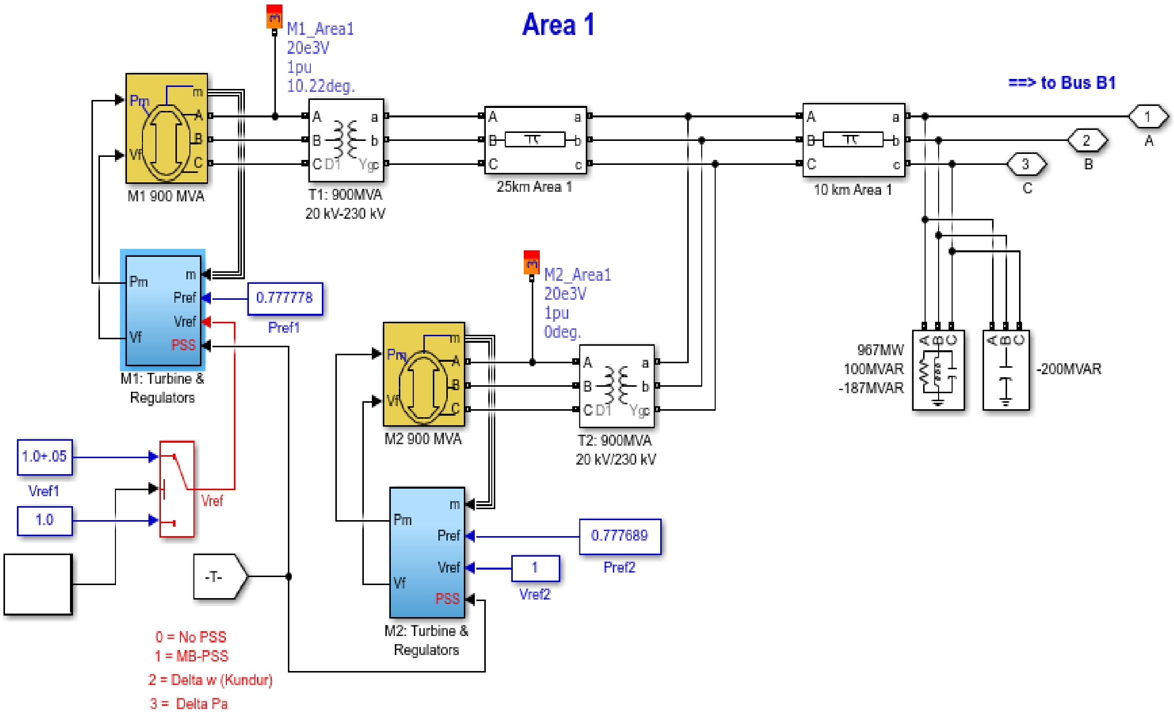

Figure 3.2:- Simulink Model of Area 1 concted to bus bar 1

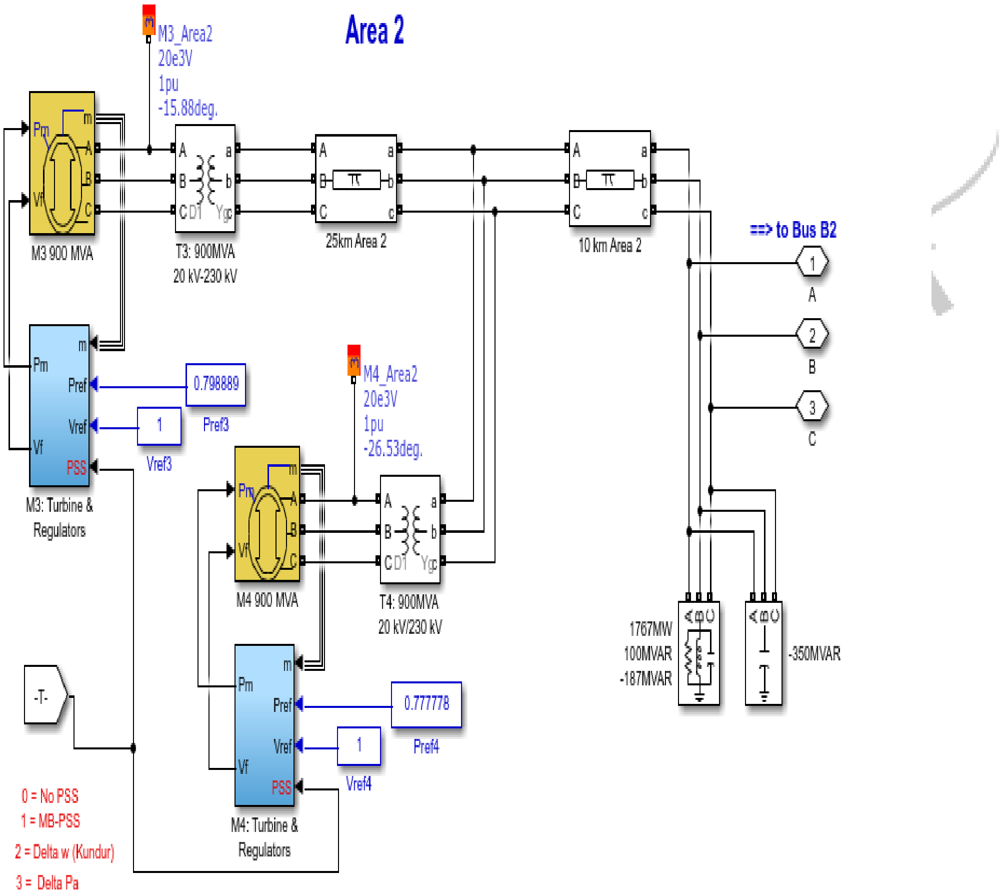

Figure 3.3:- Simulink Model of Area 2 concted to bus bar 2

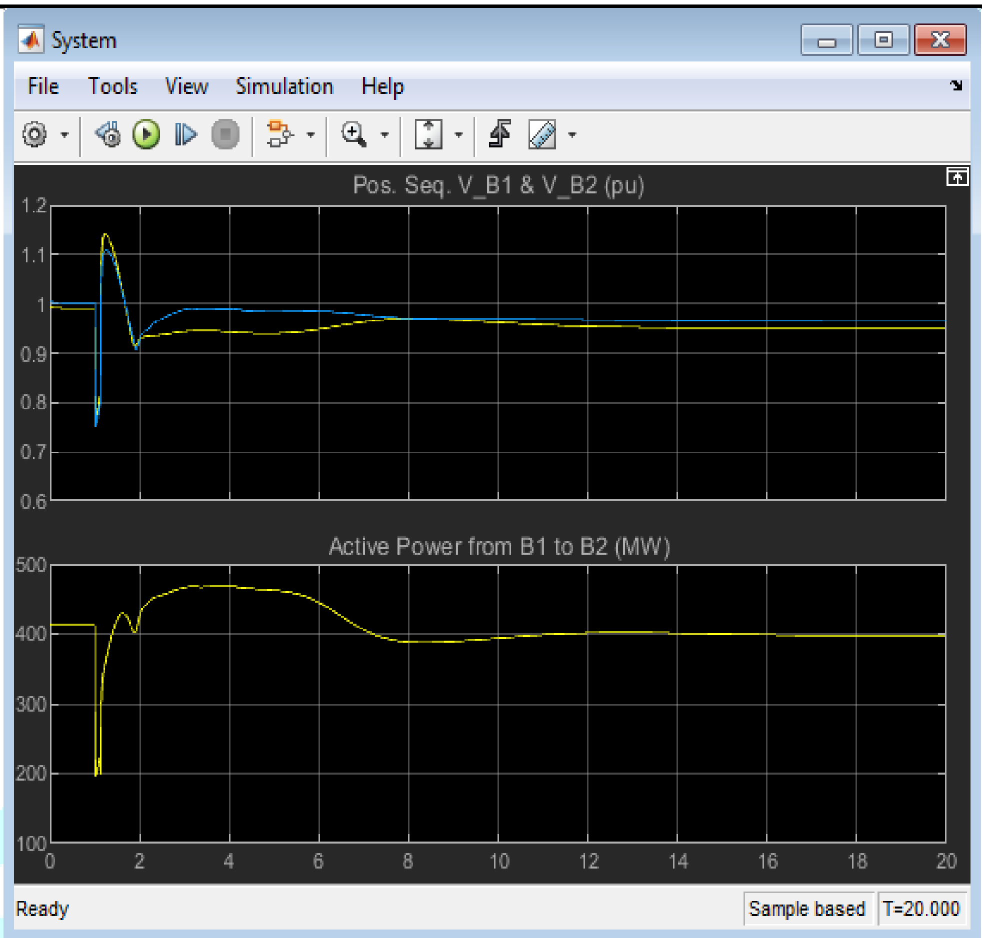

Figure 3.4:- Simulation Waveform of Pos Seq Voltage bus bar 1 and voltage bus bar 2

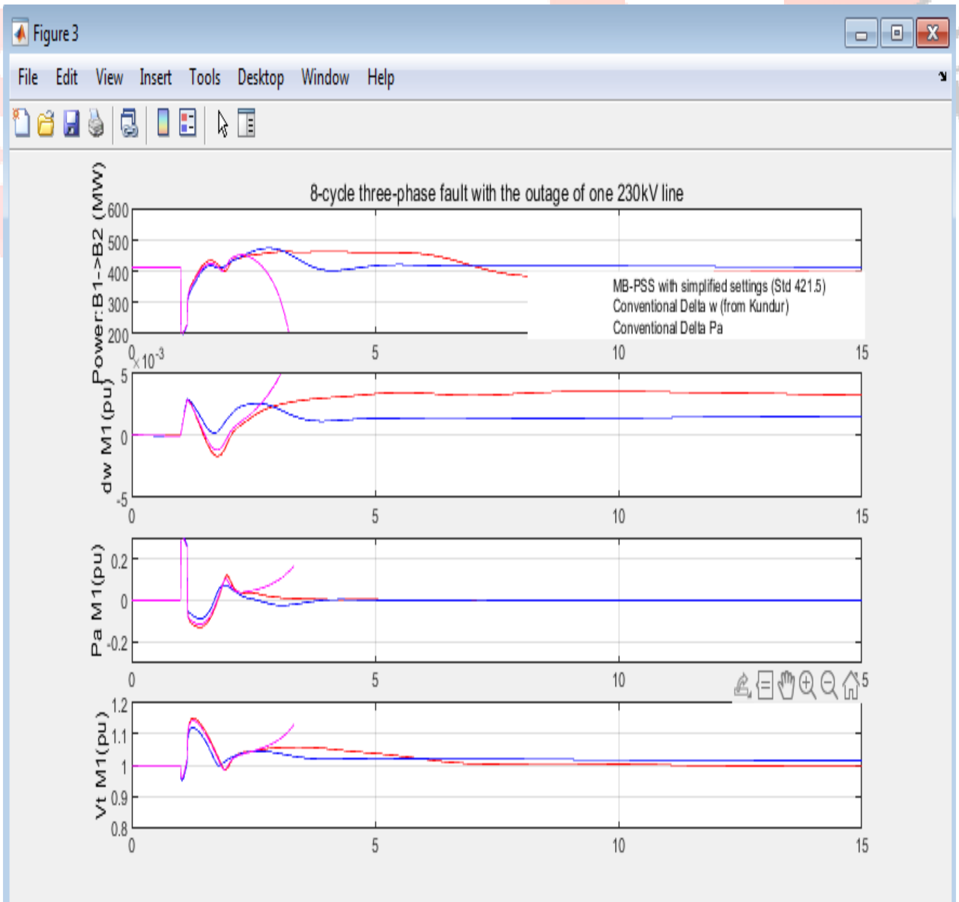

Figure 3.5:- 8-cycle three-phase fault with the outage of 230 kv line

IV. CONCLUSION

In this paper distribution system load flow analysis using MATLAB is done . The electrical power system is one of the most complex system types built by engineers Traditionally, electricity was generated by a small number of large bulk power plants that use coal, oil, or nuclear fission and was delivered to consumers through the power system in a one-way direction. Due to the modernization of the existing grid, a large number of new grid elements and functions including smart meters, smart appliances, renewable energy resources, and storage devices are being integrated into the grid. Thus, the existing electrical grid is changing rapidly and becoming more and more complex to control.

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