



EH2745 Computer Application in Power System

Assignment 2

Labelling Explanation

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Initially it was required to apply the K-Mean algorithm to know the clustering of the different states of the system in different times, then the following step is to tag every cluster according to specific features.

For the project 4 Labels were chosen:

- Generator down
- High Load and Low Load
- Line out

Label: Generator Down

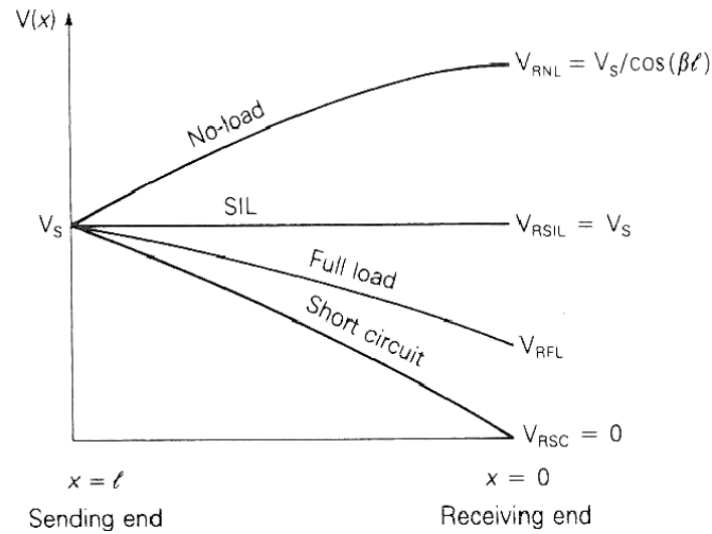
The system consists of 9 buses, 3 of them are classified as Slack bus and PU-bus (Bus 1, Bus 2 and Bus 3), both buses are connected with transmission lines to another buses. When a generator is out of operation, i.e. the machine is not injecting power into the grid, the slack bus or PU bus and their **contiguous** bus theoretically should be at the same voltage level (as there is no current flowing through the line, there is any voltage drop), as well as the phase angle, which should be the same value. Therefore, to classify the state of the system under this label, the following procedure was applied

By calculating the average angle of each cluster and the angle which is closest to a value of zero, then it will be labelled as generator down.

Labels: High Load and Low Load

By analyzing the following picture, it can be clearly understood than when the loads are demanding high amount of power, i.e. more current is being injected into the grid, causing a higher voltage-drop, therefore the voltage magnitude at the receiving point will

be lower than the sending point. By the opposite, when the loads demand low power or no power the voltage, it will lead to an increase in the voltage.



After running K-Mean there are 4 clusters with 4 centroids respectively, in order to classify two clusters as high load and low load, the average voltage magnitude of the 4 cluster is calculated. The lowest average voltage magnitude will be High Load, while the highest average voltage magnitude will be Low Load.

Label: Line Out

When a line is out, the path that the current will follow to reach the load will be larger, leading to a higher voltage drop, (as the path larger, the impedance of the path is higher). So that we can know if any cluster will be tagged as Line out, it is required to calculate all the average voltage drop (between all the connections) of each cluster for all the states. Finally the highest mean average voltage drop between the 4 cluster, it will be tagged as line out, but as the three previous cluster have been labelled, the last cluster will be automatically called “Line Out”