Paris Session 2022

C2-10550 - Synchrophasor-based Applications to Enhance Electrical System Performance in the Netherlands

C2 - Power System Operation and Control

PS1 - System Control Room Preparedness: Today and in the Future

Question 1.5:

How can we define the optimal number of synchro-phasor measurement devices for a given area?

Marjan Popov, the Netherlands

How can we define the optimal number of synchro-phasor measurement devices for a given area?

•*The optimal number of synchrophasors primarily depends on the following conditions:*

1. Grid topology (number of nodes, the number of no-load/gen buses, number of lines connected to a node).

2. The preferred level of observability (e.g. full vs partial) and redundancy (e.g. N-1 for each contingency, incl. a single synchrophasor failure).

3. The desired WAMS and WAMPAC applications in the grid (state-estimation, wide-area protection/control algorithms, backup protection, etc).

How can we define the optimal number of synchro-phasor measurement devices for a given area?

- *There are various methods for determining the optimal number and placement:*
  - There are many methodologies and some of them are Integer Linear Programming methods, Particle Swarm Optimization, Graph Theory Algorithms

- *Some are better than others, but the best one often depends on the analyzed topology*

- *To benefit from various possible WAMPAC applications (today and in the future), full observability and sufficient redundancy is desired*

- For advanced WAMPAC applications such as controlled system separation in critical system conditions (one of the outputs of our paper C2-10550), this is very much desired.

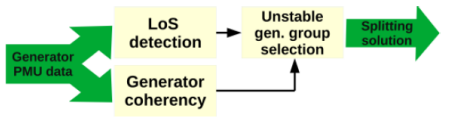

Figure 5. Decision logic of controlled splitting

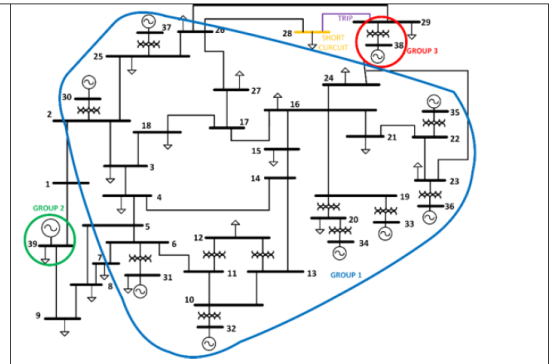

Figure 6. Three groups of coherent generators [15]

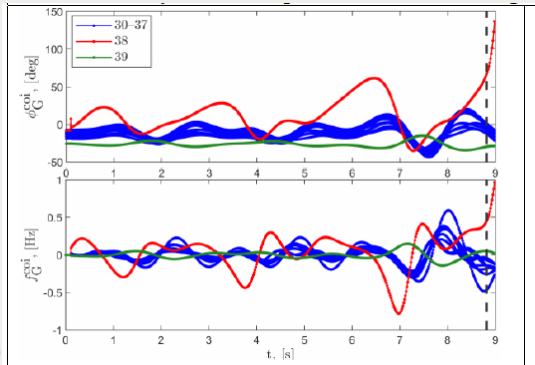

Figure 7a. Unstable transient

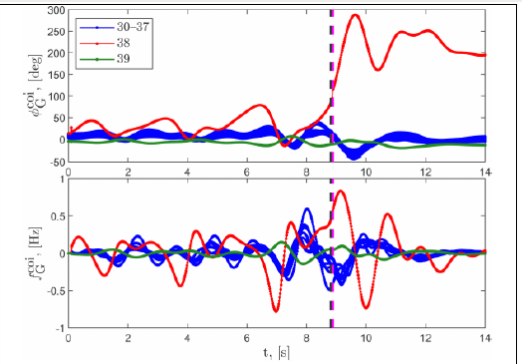

Figure 7b. Splitting transient