IMPROVED GRID RELIABILITY BY FAULT ANTICIPATION TECHNIQUES

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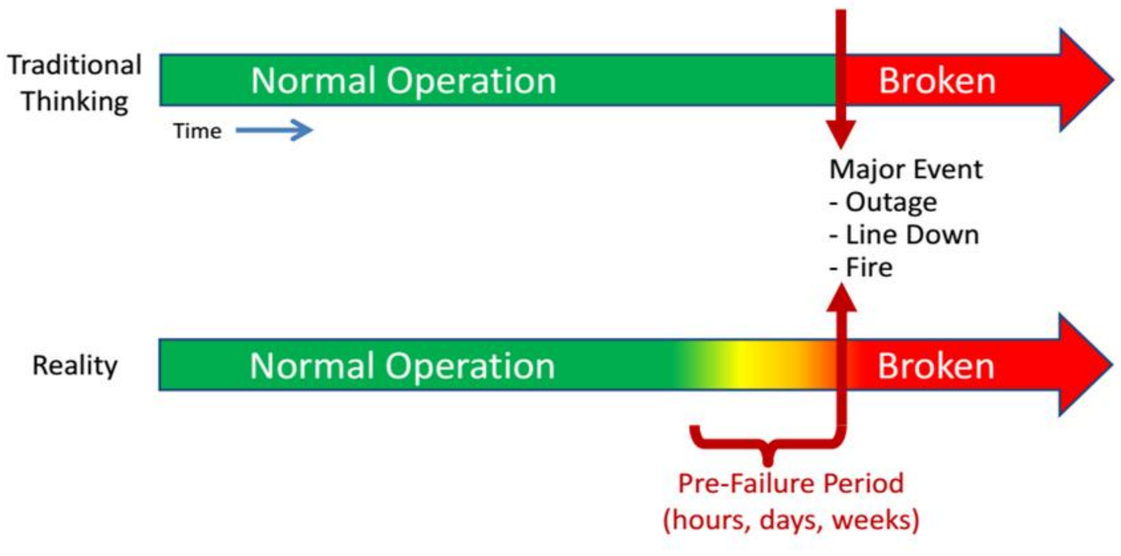
ABSTRACT : **The aim of this research work is to develop intelligent fault anticipation algorithms which can predict an upcoming fault and perform corrective switching/control actions to prevent the fault from occurring. The research would increase the reliability of the grid and reduce the possibility of prolonged power outages. The European grid is quite old and increased penetration of the renewable systems will require it to be more immune to any failure/outage. The incorporation of Information and Communication Technology (ICT) in the existing power grid has led to generation of lot of useful data which if processed efficiently can give us lot of important and crucial information about the health of the power grid. The fault anticipation technique aims to use this data to protect the grid and maintain its stability.**

CONCEPT



The "pre-failure period" in the figure above is the window of opportunity where the research will help to analyse the waveforms generated during that period to predict and classify a potentially harmful or harmless event for the power grid stability.

METHODOLOGY

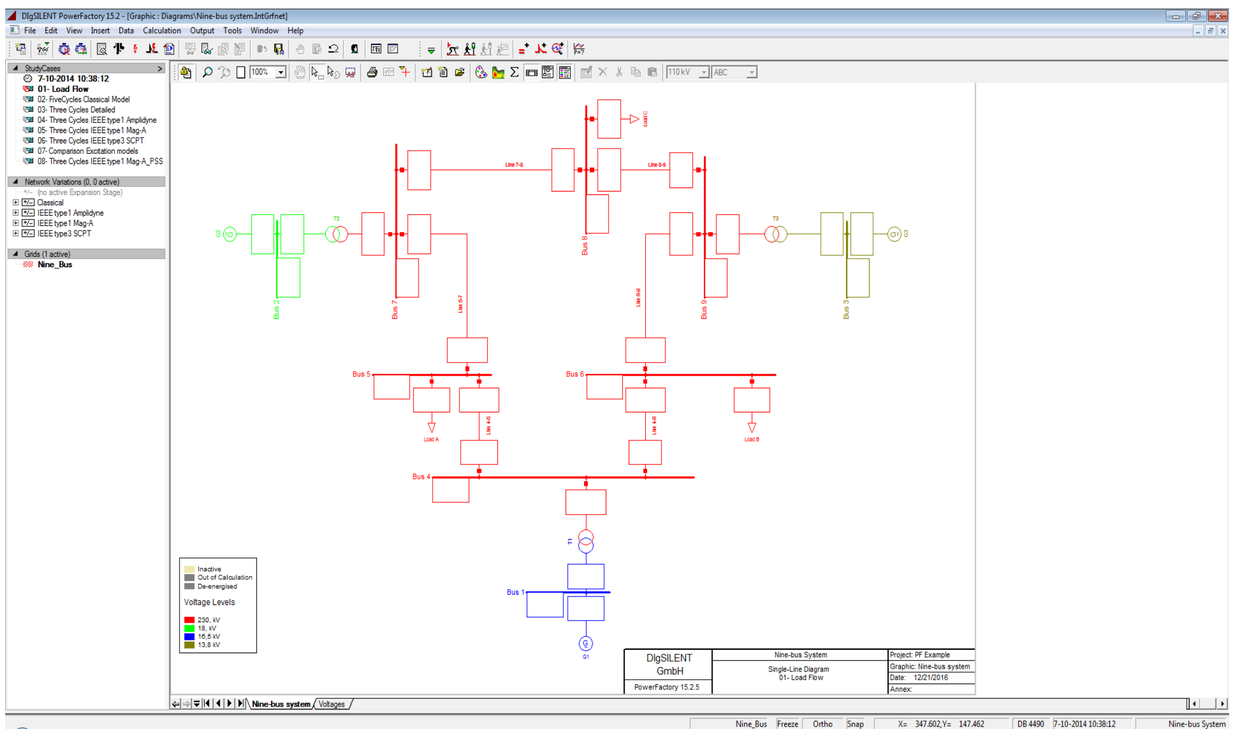
The research can be broadly classified into two major parts:

- ***PREDICTION:*** **The prediction technique aims to develop an efficient algorithm for anticipating fault like conditions in the power grid. The main idea is to use the mathematical approach called *SECOND-ORDER DERIVATIVE*.**

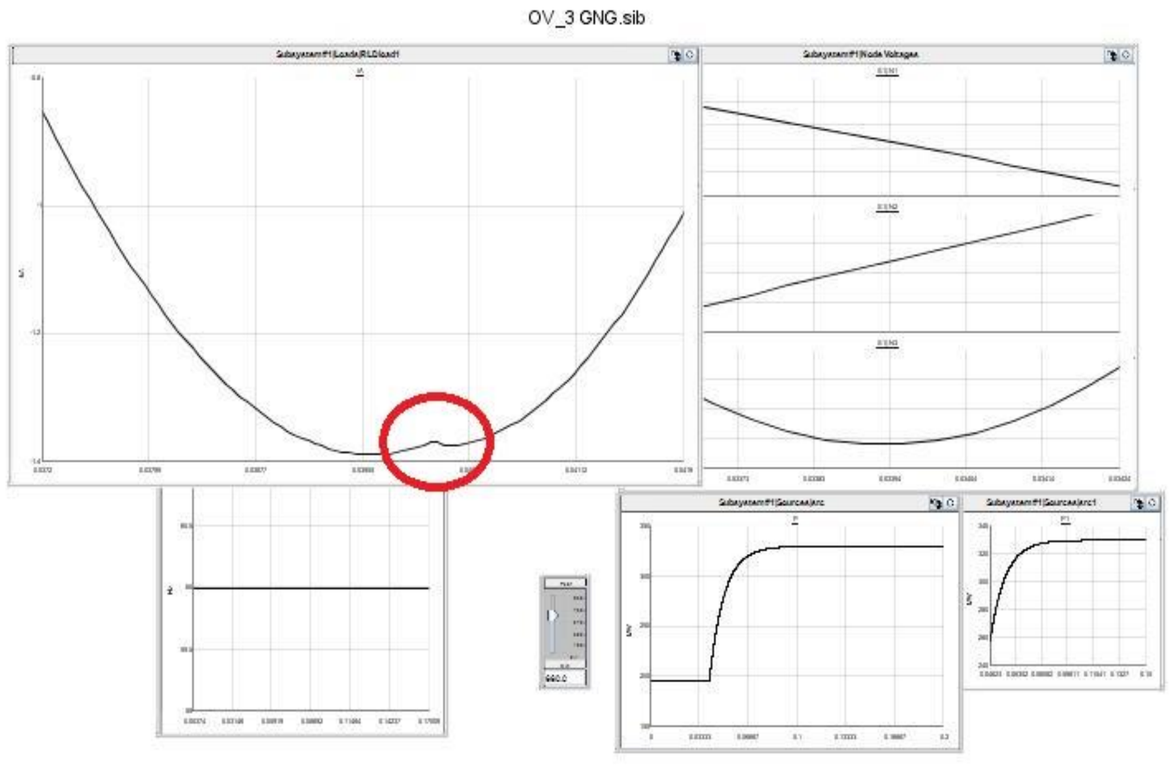
- ***PREVENTION:*** **The prediction technique will anticipate fault like conditions in the grid, hence the next step would be to mitigate them before it affects the stability of the power grid. The preventive actions are generally unique to every grid and would require considerable amount of data analysis and machine learning. The idea is to have a master control which does the analysis of the data fed to it from the sensors, takes the corrective actions and relays back it to the grid.**

PRELIMINARY RESULTS

The initial research was conducted on a standard IEEE 9-bus test system. Some specific faults and scenarios were finalised which would be used to test the algorithms developed during the research work.



THE IEEE 9-BUS system on which the various fault like scenarios have been modelled and simulated.



Distortion in the waveform indicates a fault like condition which the prediction technique will detect and accordingly the prevention technique will act to maintain the stability of the grid.

ERIGRID PROJECT

The research work in the testing phase would use real time simulator like RTDS and other important software's like PowerFactory, MATLAB, etc. The aim is to couple and encapsulate these software's using FMI (functional mock-up interface). *Co-simulation* is the technique used for coupling different simulation packages. This idea is in alignment with the *European Commission Horizon 2020 project: 'ERIGRID'*, where the aim is to develop a single testing and validating platform for future smart grids using the co-simulation technique. *ERIGRID* aims to create a flexible toolset/ library to couple simulation packages for Smart Grids by using both existing tools and developing new ones to bridge the gap.

TU Delft Delft University of Technology

IEPG Intelligent Electrical Power Grids

THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION HORIZON 2020

erigrid Connecting European Smart Grid Infrastructures