Power System Condition Monitoring Using Synchronized Waveforms

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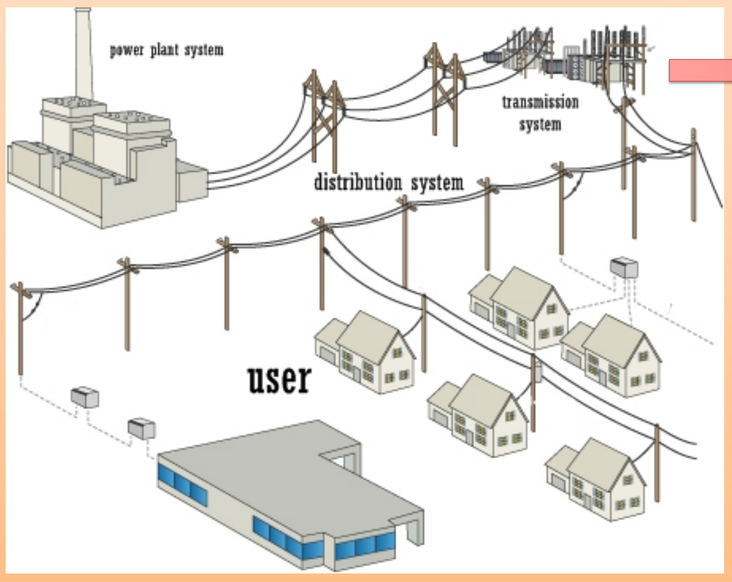
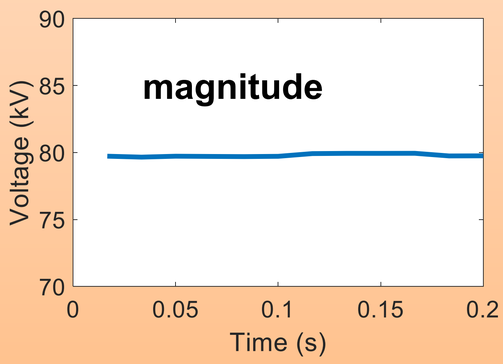
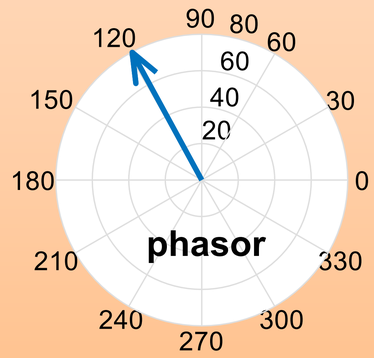
Frontier in Power System Monitoring - Synchronized Waveform Monitoring System (SWMS)

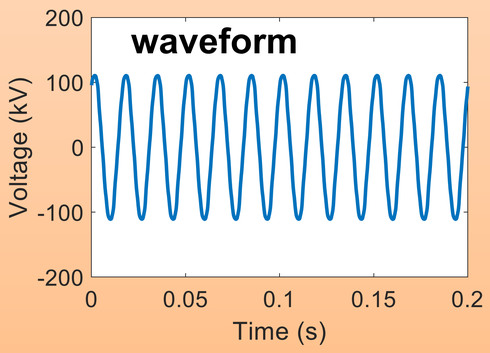
Several decades ago, **magnitude data** collected by the **SCADA** systems was made available for power system monitoring. This data became the foundation of the classic Energy Management Systems. Around the beginning of this century, **60Hz phasor data** emerged. It has resulted in the creation of modern **Wide Area Monitoring Systems (WAMS).** In view of the advances in hardware technologies, it is not difficult to envisage that the next advancement will be the capturing of **waveform data** synchronously at various locations of a power system. Such systems may be called the "**Synchronized Waveform Monitoring Systems (SWMS)**". Since waveforms represent **the most granular data** that can be collected for power systems, a new generation of tools for power system situational awareness is expected to emerge. This poster discusses two potential applications of SWMS in power system condition monitoring.



SCADA → WAMS → SWMS

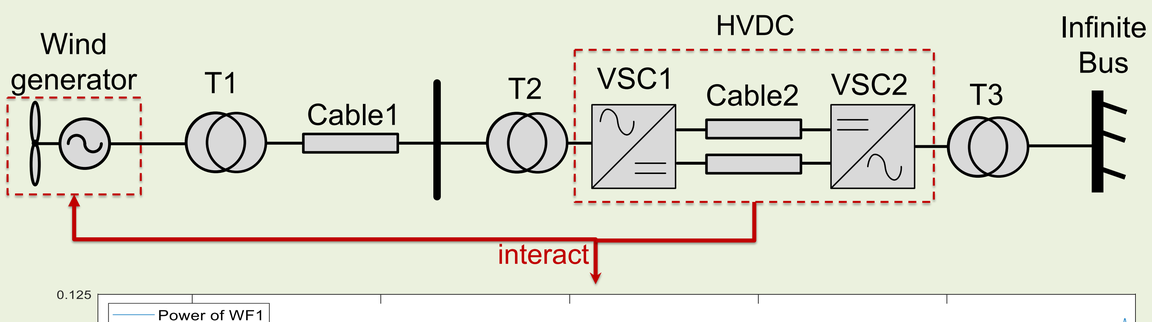


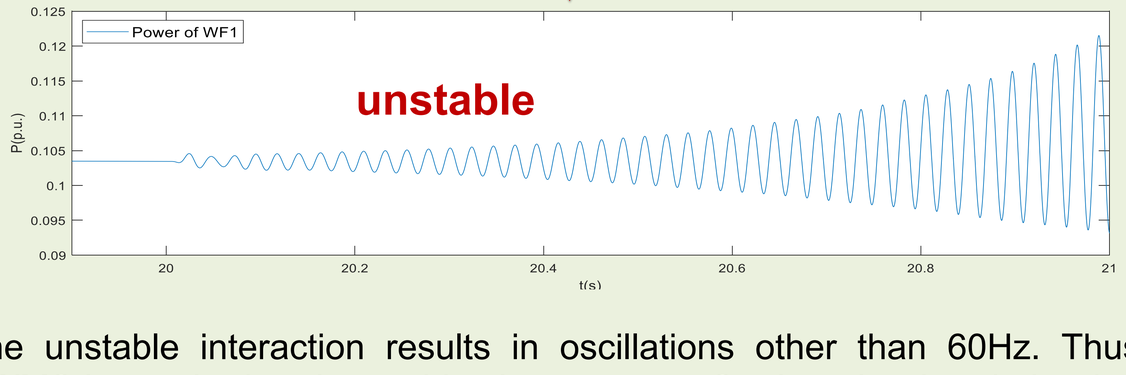




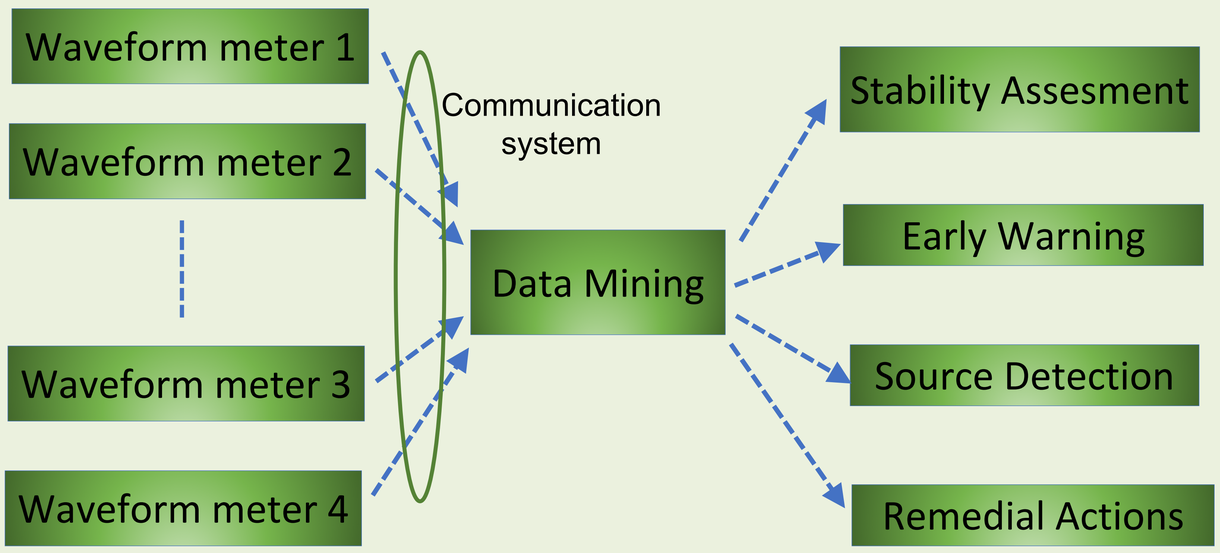
Application 1: Power System Stability Monitoring

Nowadays the power system is becoming more and more complex in structure, operation and control mainly due to the proliferation of power electronic devices, such as High Voltage Direct Current (HVDC), wind farm, solar farm, etc. An emerging concern is the unstable interactions between power electronic devices.



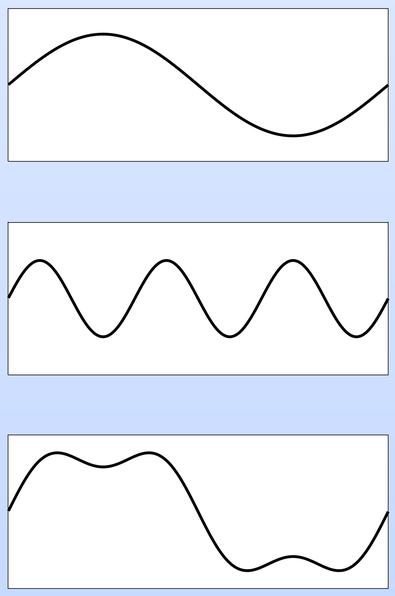


The unstable interaction results in oscillations other than 60Hz. Thus, SWMS is required to detect this phenomenon. On the other hand, the data mining technique is developing rapidly in recent years, which makes it possible to provide a deep insight into the stability problem such as detecting the oscillation source and providing suggestions on remedial actions.



Application 2: Power Quality Monitoring

Power systems are designed to supply the power that is always available, always within voltage and frequency tolerances, and has a pure noise-free sinusoidal wave shape. However, certain type of loads such as power electronic devices, could make the supply deviate from its ideal. Poor power quality adversely affects both power system components and customers' devices.



Good power quality
(pure 60Hz sinusoidal wave)

+

180Hz waveform

=

Poor power quality
(distorted waveform)

Most power quality disturbances can only be observed from the waveform data. Thus, SWMS makes it possible to monitor the system-wide power quality conditions. Besides, with the development of data mining technique, advanced applications of SWMS data such as the disturbance source detection can be realized as well.