Comparative Study of Power Quality Event Characterization using Scalable Vector Graphics & Matlab

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Abstract. The research delves into the topic of power quality event extraction and compares two parameters—voltage sag/swell and harmonics—using data supplied by SVG and waveforms created by Matlab. When it comes to power quality analysis, the SVG method shines through in the qualitative comparison of findings.

1. INTRODUCTION

There has been a resurgence of interest in studying power quality issues as a means of bettering the reliability of the power grid in recent years. Research on power quality will get more attention as the number of sensitive electronic devices keeps growing. [1]

Over the last several years, researchers have begun to examine power quality issues by analyzing recorded disturbance waveforms. The nature of the relevant power quality issues may be gleaned from the voltage and current time-series recordings of these problems. Because each episode is distinct, these characteristics are useful for showing how power quality interruptions occur and for pinpointing where they come from. In this study, we provide methods for extracting power quality events from produced waveforms and describe the distinctive properties that characterize these events [2].

The fourth part provides an overview of power quality analysis using Scalable Vector Graphics. This section presents and discusses the findings. Section VI concludes the whole thing.

1. The LNCS Editorial has made the assumption that all authors have followed the western naming practice, which states that first names should come before last names. This establishes the format for the author index and running headers.

2. Problems and Issues with Power Quality

Power electronics for high-performance drives and power system operation and control have been on the rise. Problems with power quality, including voltage sag/swell and harmonics, may lead to broken machinery. Because of sensitive loads tripping because of low power quality, industries have lost production and profit margins. Thus, it is essential that we comprehend power quality issues and ascertain the optimal remedy. the third Electricity quality is of interest: Voltage disturbances are caused by equipment that has become more sensitive to them. Standardization and performance requirements are becoming more important. "Utilities aim to provide high-quality products. "Variation has value at any given instant;

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Type 1 V&I features are identical to their nominal or intended value. There are several reasons for the variations: all variations in load. The process of swapping out reactors or capacitor banks. Type 2: Unexpected changes are known as occurrences. To illustrate:

Reduced voltage caused by the functioning of the CB. Quality Measures for Power: Fluctuations

include flickering voltage, A drop in voltage, voltage surge, Disruptions, Electrical, Inconsistencies, People who arrive and go quickly, Electrical interference. An electrical disturbance plus a route plus susceptible equipment equals power quality equation.

3. POWER QUALITY PARAMETER CHARACTERIZATION

For the purpose of characterization, data may be extracted from specific power quality events recorded using any of the segmentation or triggering techniques. Issues pertaining to the process of feature and information extraction from digital signal measurements.

In other words, information may be retrieved from voltage and current waveforms that have been sampled. With each passing stage, the one before it is improved upon. In this case, signal processing is used to improve and extract the concealed information. [6]. Every power quality event has its own unique set of characters.

Quantifying supply using site or system indices begins at this stage.

Step1: Characteristics as a function of time may be calculated after receiving the waveform.

Step 2: We get single event indices from attributes vs time.

Step3: One way to measure the seriousness of an incident is to look at its individual qualities.

Table1. Power quality issues

Power Quality Variation Category	Method of Characterizing	Typical Causes	Example Power Conditioning Solutions
Impulsive Transients	Peak magnitude, Rise time, Duration	Lightning, Electro-Static Discharge, Load Switching	Surge Arresters, Filters, Isolation Transformers
Oscillatory Transients	Waveforms, Peak Magnitude, Frequency Components	Line/Cable Switching, Capacitor Switching, Load Switching	Surge Arresters, Filters, Isolation Transformers
Sags/Swells	RMS vs. time, Magnitude, Duration	Remote System Faults	Ferroresonant Transformers, Energy Storage Technologies*, UPS
Interruptions	Duration	System Protection (Breakers, Fuses), Maintenance	Energy Storage Technologies*, UPS, Backup Generators
Undervoltages/ Overvoltages	RMS vs. Time, Statistics	Motor Starting, Load Variations	Voltage Regulators, Ferroresonant Transformers
Harmonic Distortion	Harmonic Spectrum, Total Harm. Distortion, Statistics	Nonlinear Loads, System Resonance	Filters (active or passive), Transformers (cancellation or zero sequence components)
Voltage Flicker	Variation Magnitude, Frequency of Occurence, Modulation Frequency	Intermittent Loads, Motor Starting, Arc Furnaces	Static Var Systems

*Note: Energy Storage Technologies refers to a variety of alternative energy storage technologies that can be used for standby supply as part of power conditioning (e.g. superconducting magnetic energy storage, capacitors, flywheels, batteries)

4. INTRODUCTION TO SCALABLE VECTOR GRAPHICS

Vector graphics that may be scaled up or down are known as SVG.SVG is a la1nguage for defining XML-based vector graphics for usage on the web. Regardless of how much you zoom in or out, the quality of SVG graphics will remain intact. It is possible to add animation to any SVG element or property. A suggestion from the World Wide Web Consortium (W3C) is SVG. DOM and XSL are two more W3C standards that SVG is compatible with.[9].

SVG Background and Benefits

Two-dimensional vector drawings may be described using SVG, a text-based graphics language that is based on the XML format. SVG is able to display raster pictures, text, and vector graphic objects like routes made of straight lines and arcs. Web Consortium's Scalable Vector visuals (SVG) is an XML-based open standard for representing 2D visuals and graphical applications. January 2003 saw SVG 1.1 become a W3C Recommendation. Several companies have contributed to the specification of SVG, including Sun Microsystems, Adobe, Apple, IBM, and Kodak.

Scalable vector graphics (SVGs) are smaller, more compressed, and readable by a wide variety of programmers (e.g., notepad).SVG pictures are both zoomable and print-ready at any resolution. No quality loss occurs when zooming in on any area of the picture. In addition to being an open standard, SVG files are pure XML, and the text inside them can be selected and searched—making them ideal for use in map-making. SVG is also compatible with Java technology. Flash is SVG's biggest rival. Being interoperable with other standards, such the DOM and XSL, is a big advantage of SVG versus Flash. Flash is dependent on non-open-source proprietary technologies.[9]

To open SVG files in modern browsers, a plug-in like Adobe SVG Viewer may be required. Exploring SVG Files & Downloading an SVG viewer is necessary to access SVG files in the event that your browser does not natively support them. Notably, native support for SVG is available in Firefox 1.5 and Opera 9. You can skip installing an SVG viewer if you're using one of these browsers.

The process of getting Adobe's SVG Viewer.

With Adobe® SVG Viewer 3, you can see online visuals that are data-driven, dynamic, and personal. Set Up Adobe SVG Viewer and Launch the installation file that you downloaded by double-clicking it.

Table2. Specifications

Language	**Operating system**	**Version**	**Date**
English	Win 98 XP	3.03	04/2005
	Mac 8.6 9.1	3.0	11/2001
	Mac 10.1 10.4	3.0	11/2001
	RedHat Linux 7.1 9e	3.01 beta 3	12/2003
	Solaris 8	3.0 beta 1	11/2001

Proceeding as directed by the on-screen prompts' starting your browser is necessary to see SVG files if you are not using Internet Explorer for Windows. A Crash Course in MATLAB and SIMULINK. Technical computing makes use of the high-performance language MATLAB. It provides a user-friendly environment that combines calculation, visualization, and programming. Mathematical notation is used to explain problems and their solutions. Common applications comprise: "Computation and mathematics", development of algorithms, gathering data, creating models, running simulations, and creating prototypes. Investigating, analyzing, and visualizing data Engineering and scientific visuals. Developing applications, which may include creating graphical user interfaces. An interactive system, MATLAB's fundamental data element is a dimension-free array. Many technical computer problems, particularly those using matrix and vector formulas, may be solved much more quickly in this way. Matrix laboratory is the acronym for the term MATLAB. A MATLAB toolbox is a collection of pre-built solutions tailored to a particular purpose. There are toolboxes available for a wide variety of fields, including control systems, neural networks, signal processing, fuzzy logic, and wavelets modeling.

5. SIMULATION

Modelling, simulating, and analyzing systems with time-varying outputs is made possible with the help of Simulink, a software tool. Dynamic systems are a common name for such configurations. An endless number of mechanical, thermodynamic, and electrical systems may have their behavior examined using Simulink, including electrical circuits, shock absorbers, braking systems, and many more.

With Simulink, there are two steps to simulate a system that is always changing. To begin, one must use the Simulink model editor to construct a visual representation of the system that will be emulated. All of the inputs, states, and outputs of the system are represented mathematically in the model, and these connections change with time.

The next step is to run simulations of the system's behavior over a certain time period using Simulink. When running a simulation, Simulink relies on data input by the user. A state-of-the-art design tool, the power system block set enables engineers and scientists to construct power system simulation models with ease and speed. The Simulink environment is used by the block set.

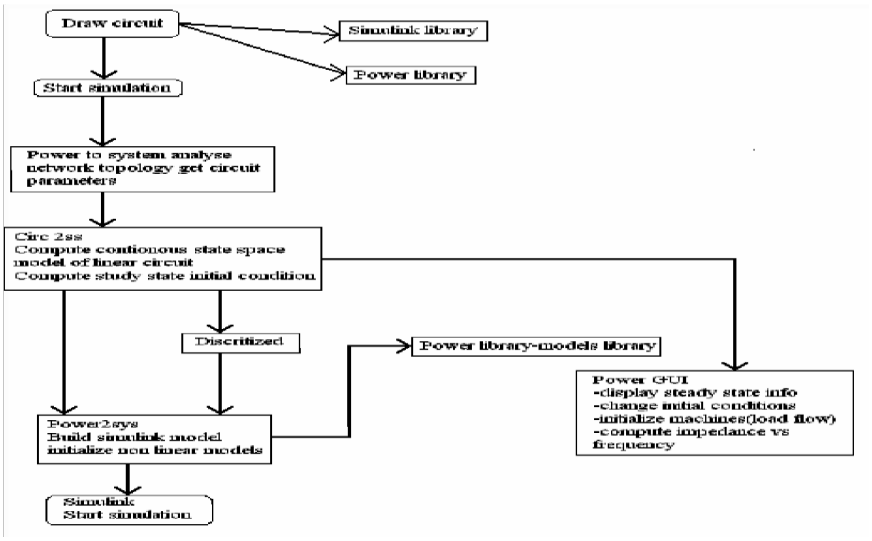

Fig. 1. Block diagram of the system

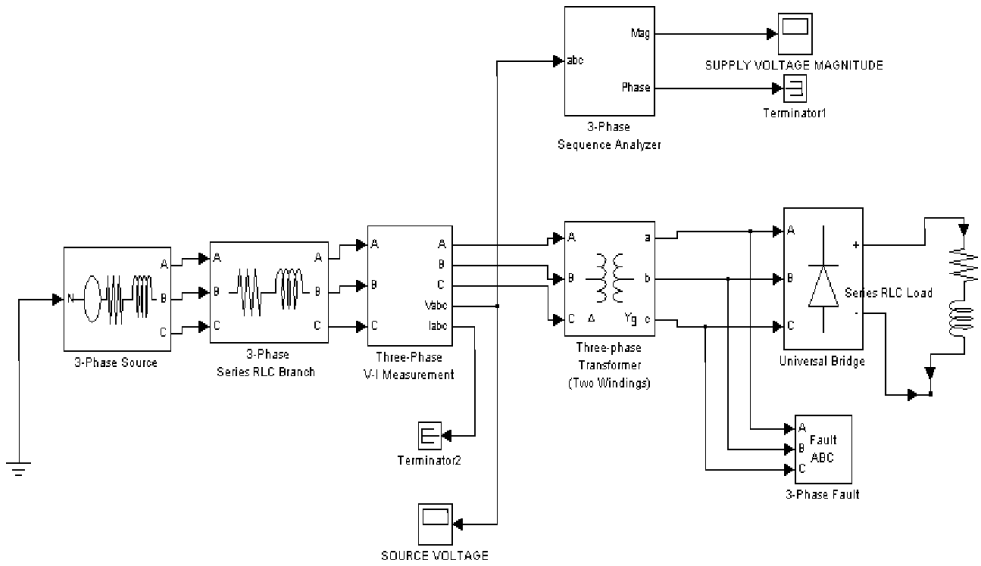

Fig. 2. Circuit Model in Matlab

6. RESULTS

Voltage Sag Generation:

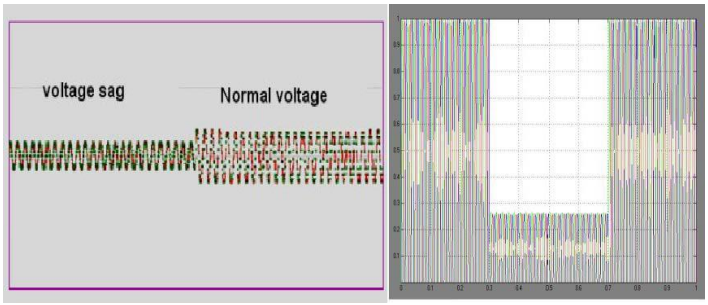

Fig. 3. Using SVG Using Matlab

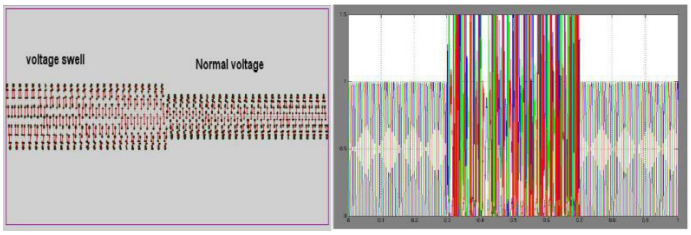

Fig. 4. Voltage Swell Generation: Using SVG using Matlab

WDFFT, RMS OUTPUT FOR VOLTAGE SAG, SWELL, HARMONICS

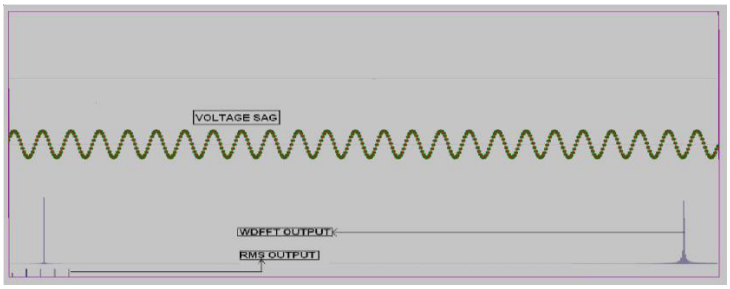

Fig. 5. Voltage Sag

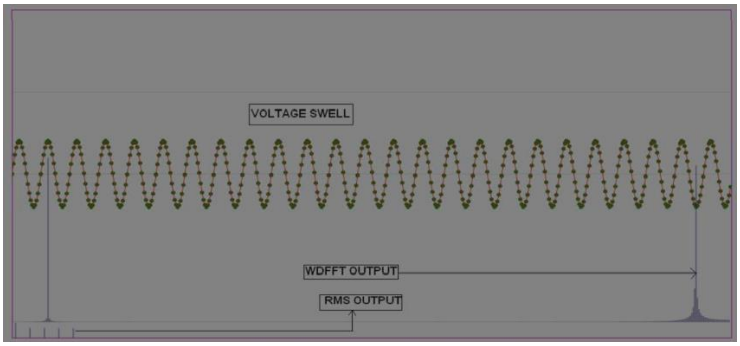

Fig. 6. Voltage Swell

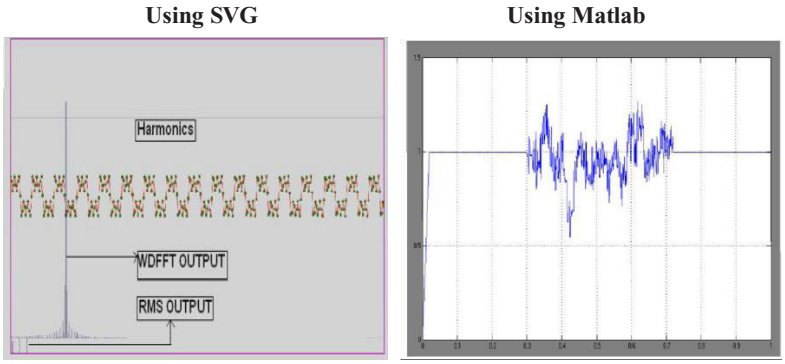

Fig. 7. Harmonics

7. CONCLUSIONS

Given their incident-specific nature, the research employs these characteristics to demonstrate the process of power quality disturbances and to determine their origins. The algorithm's output allows for a thorough investigation of the network event and the selection of suitable mitigation strategies.

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