VOLTAGE VARIATION SOURCE IDENTIFICATION SYSTEM

MUHAMAD ZAINAL BIN HAMZAH

BACHELOR OF ELECTRICAL ENGINEERING WITH HONORS
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2019

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MUHAMAD ZAINAL BIN HAMZAH

A report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering with Honours

Faculty of Electrical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2019

DECLARATION

I declare that this thesis entitled “VOLTAGE VARIATION SOURCE IDENTIFICATION SYSTEM” is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : .....

Name : .....

Date : .....

APPROVAL

I hereby declare that I have checked this report entitled “voltage variation source identification system” and in my opinion, this thesis it complies the partial fulfillment for awarding the award of the degree of Bachelor of Electrical Engineering with Honours

Signature : .....

Supervisor Name : .....

Date : .....

DEDICATIONS

To my beloved mother and father

ACKNOWLEDGEMENTS

Alhamdulillah. I am greatly indebted to Allah on His mercy and blessing for making this research successful

Secondly, I wish to express my sincere appreciation to my supervisor, PM. Ir. Dr. Abdul Rahim Abdullah for his encouragement, guidance and valuable advices, without his continued support and interest, this thesis would not have been the same as presented here. Besides that, I would like to express my thankfulness to the technical staff of the Research Laboratory of Advance Digital Signal Processing (ADSP) for their assistance and opinion while performing the work of the research.

Next, I would like to express my thankful to Universiti Teknikal Malaysia Melaka (UTeM) for finding and providing the necessary infrastructure that enables the completion of this report.

Finally, I am also very grateful to all my family, friends and relative for their patience, prayers and understanding over the entire period of my studies. Thank you very much.

ABSTRACT

In this report, the power quality (PQ) disturbance which is the voltage variations consist of voltage swell, sag and interruption are model and analyse. Different types of voltage variations PQ disturbances models are developed and created by using MATLAB/Simulink. The Simulink model are display in terms of time-frequency representation (TFR). The Simulink models include shutting down enormous capacities from system to resemble voltage swell, large loads energizing and three-phase fault to simulate voltage sag as well as implementing permanent three-phase fault to simulate voltage interruption. The signals generated are analysed by using linear time-frequency distribution (TFD). The signal parameters such as root mean square voltage (Vrms), total harmonic distortion (THD) and power value are estimated from the TFR to identify the characteristics of the voltage variation. The results of analysis on the PQ disturbance waveforms generated are identical to the actual real-time PQ signals and the models can be modified to any desired situation respectively. The PQ waveforms obtained are suitable to be further analysed.

ABSTRAK

Dalam laporan ini, gangguan kualiti kuasa (PQ) yang merupakan variasi voltan yang terdiri daripada pembengkokan voltan, kekacauan dan gangguan adalah model dan analisis. Jenis-jenis variasi voltan yang berbeza PQ gangguan model dibangunkan dan dibuat dengan menggunakan MATLAB / Simulink. Model Simulink dipaparkan dari segi perwakilan frekuensi masa (TFR). Model Simulink termasuk menutup kapasiti besar dari sistem untuk menyerupai pembengkakan voltan, beban besar yang bertenaga dan kesalahan tiga fasa untuk mensimulasikan bebola voltan serta melaksanakan kesalahan tiga fasa tetap untuk mensimulasikan gangguan voltan. Isyarat yang dihasilkan dianalisis dengan menggunakan pengedaran frekuensi masa linear (TFD). Parameter isyarat seperti voltan kuasa min (Vrms), jumlah penyelewengan harmonik total (THD) dan nilai kuasa dianggarkan dari TFR untuk mengenal pasti ciri-ciri variasi voltan. Hasil analisa pada bentuk gelombang gangguan PQ yang dihasilkan adalah sama dengan isyarat PQ masa nyata sebenar dan model-model boleh diubah suai ke mana-mana keadaan yang dikehendaki masing-masing. Borang gelombang PQ yang diperoleh adalah sesuai untuk dianalisis selanjutnya.

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LIST OF SYMBOLS AND ABBREVIATIONS

PQ	-	Power Quality
TFR	-	Time-Frequency Representation
TFD	-	Time-Frequency Distribution
THD	-	Total Harmonic Distortion
RMS	-	Root-Mean-Square
ADSP	-	Advance Digital Signal Processing
AC	-	Alternative Current
IEEE	-	Institute of Electrical and Electronics Engineers
IEC	-	International Electrotechnical Commission
FFT	-	Fast Fourier Transform
GUI	-	Graphical User Interface
STFT	-	Short-Time Fourier Transform
SLG	-	Single Line-to-Ground

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Power quality (PQ) of the power system has become a major concern for consumers at all levels of use, as the impacts and losses caused by the quality of power cannot be ignored. The term power quality is the blend of voltage and current quality, yet the union point is presently centered around the nature of the supply voltage, since just the power framework itself can control the nature of the voltage. [1][2]. Various types of faults, improved nonlinear loads and power system operations often create disturbances in the power quality. Any voltage, current or frequency deviation that results in equipment failure or failure is a problem with power quality. [3][4][5]. Poor power quality can cause issues, for example, decrease the lifetime of the heap, insecurities and interferences underway and also deadly expenses because of downtime of the hardware as shown by IEEE Std. 1159-2009 [6][7]. It is imperative that unsettling influences inside the power framework are disposed of or decreased. So as to play out the power quality flag investigation technique, it is important to get an unmistakable perspective of the essential attributes of intensity quality and the parameters of every occasion. [8][9].

This report inspects voltage variety, which incorporates voltage droop, swelling and intrusion in the substance of intensity quality aggravations and outlines their parameters. Voltage hang can be created by short circuits in the transmission arrange, the beginning of extensive engine bundles or the exchanging activity with short supply disengagement.

Similarly, voltage swell can be caused by system failure, by exchanging a state on a large condenser bank or by switching off a large load on a power system. Voltage interruption is usually caused by permanent power failure [8][9][10][11][12].

Waveform perturbations of power quality can be artificially generated using software - based simulation models. Various types of simulation software can be used to model voltage variation events. The most widely used are ATP/EMTP, MATLAB/Simulink and PSCAD/EMTDC. In [13][14][15]16], the authors used PSCAD / EMTDC software to replicate the actual variation signals. However, the transfer of data to MATLAB software is necessary for further analysis. MATLAB / Simulink is one of the simulation devices for real time systems design and interpretation [17][18]. The Simulink tool stash can be utilized to show the power quality aggravations in real appropriation framework in adequate way [19]. This report presents re-enactment models in MATLAB/Simulink used to produce different sorts of voltage variety.

Numbers of techniques were discussed by research workers for analyzing power quality problems [20][21][22]. The spectrogram strategy is utilized in this answer to break down the aggravations by speaking to the procured flags as time recurrence portrayal (TFR). The parameters got from the model Simulink, for example, control, root-mean-square voltage (Vrms) and aggregate symphonious mutilation (THD), are then evaluated from the TFR and after that arranged.

1.2 Motivation

In this part stated why this research has been done. This research more refers to the voltage variation that's include voltage sags, voltage swells and interruption. Each type of voltage variation has their own characteristic and the cause for all of each type were different

and the effect of the three variation also different that can be monitoring by signal processing techniques. The attraction to the voltage variation is that it's could determine the waveform that produce from voltage to analyses whether there is distortion or not in the waveform that can be display using the spectrogram.

This research has been done because the machine in the industry always breakdown without knowing the causes of the breakdown. The characteristics of the voltage variations can be used to identify the causes of the breakdown. That's why the analyzation of the signal has been done to reduce the breakdown of the machine and to find the causes of the breakdown using the voltage sags, voltage swells and interruption signal characteristics.

1.3 Problem Statement

There were many issues within the industry nowadays, the issue that have been produced will affect everything about the industry and will not be satisfied the consumer. One of the issues that always been disputed are the machine always breakdown without knowing the source of the breakdown and it is too hard to determine which one of the machines were breakdown. If the machine of the industry is breakdown it will affect everything such as slow down the work, the quality of the product will be worse and many others more.

A monitoring system is required to display the voltage variation of the machine in industry. It is important to monitoring the voltage variation of the machine of in industry which why if the breakdown occur it just only can be found by monitoring the machine in industry and can be classify without hesitation which machine were breakdown because the result that have been produced from monitoring the machine were accurate.

The signal processing method is required in analyzing the variation signals. The function to analyzing the signal so that it can be determined the source of the breakdown of the machine and the causes of the breakdown can be repair or can be prevent earlier before it happens.

1.4 Objective

The objectives of this research are:

- To analyze voltage variation signal using digital signal processing technique
- To classify voltage variation signals
- To evaluate the performance of the classification system

1.5 Scope

The scope for this research is the identification of voltage variation signal between:

- Voltage sags
- Voltage swells
- Interruption

The experimental for this research are by using the MATLAB/Simulink for the modelling then classify the signal using digital signal processing technique.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter will discuss about the voltage variation in the topic of power quality. Voltage variation is one of the power quality phenomena. There are 3 type of voltage variation according to power quality phenomena that is voltage sags, voltage swells and interruption. This chapter will explain briefly about the phenomena of each type.

2.2 Power Quality

The nature of power or just the nature of intensity incorporates voltage, recurrence and waveform. Great power quality can be characterized as a steady supply voltage inside the recommended AC extend. Recurrence near the evaluated esteem and smooth waveform of the voltage bend (like a sine wave). As a rule, it is helpful to consider control quality as the similarity between what results from an electrical outlet and the heap associated with it. The term is utilized to portray power that drives an electric charge and the correct working of the heap. An electrical gadget (or load) may glitch, bomb rashly or not work at all without the right power. There are various ways that power can be of low quality and a lot more reasons for such low quality. The power business includes power age (AC control), power transmission and at last power circulation to a power meter toward the end client 's premises. The power at that point travels through the wiring arrangement of the end client until the point when it achieves the heap. The framework's intricacy in moving power from the purpose of creation to the point of utilization, joined with varieties in climate, age, request and different variables, offers numerous chances to bargain the nature of the supply.

Despite the fact that control quality is a helpful term for many, the term really depicts the nature of the voltage instead of the power or electric flow. Power is basically the vitality stream and the current requested by a heap can't be controlled.

2.2.1 Definition of Power Quality

The electrical gear's capacity to utilize the vitality provided. There are various issues with power quality, including electrical music, poor power factor, voltage insecurity and a lop-sidedness in the productivity of electrical frameworks. This has various results, including expanded vitality utilization and costs, expanded upkeep expenses and shakiness and disappointment of hardware.

2.2.2 Power Quality Standards (IEEE)

Table 2.1: IEEE Standards of Voltage Variations

Categories	Typical Duration	Typical Voltage Magnitude
Variations		
1.1 Instantaneous		
1.1.1 Sag	0.5-30 cycles	0.1-0.9 pu
1.1.2 Swell	0.5-30 cycles	1.1-1.8 pu
1.2 Momentary		
1.2.1 Interruption	0.5 cycles-3 s	<0.1 pu
1.2.2 Sag	30 cycles-3 s	0.1-0.9 pu
1.2.3 Swell	30 cycles-3 s	1.1-1.4 pu
1.3 Temporary		
1.3.1 Interruption	>3 s-1 min	<0.1 pu
1.3.2 Sag	>3 s-1 min	0.1-0.9 pu
1.3.3 Swell	>3s-1 min	1.1-1.2 pu

2.3 Power Quality Phenomena

2.3.1 Voltage Variation

The empowerment of substantial burdens requiring high beginning flows or irregular free associations in power wiring quite often cause voltage varieties. The deformity can cause impermanent voltage builds (swells), voltage plunges (droops) or a total loss of voltage (interferences) contingent upon the area of the imperfection and the framework conditions. The state of the blame can be close or remote from the focal point. In either case, the effect of the present blame condition on the voltage is a brief length variety. Changes in current qualities that fall into classes of span and greatness are likewise incorporated into transient variations.

2.3.1.1 Voltage Sag

The voltage list is a momentary decline in the voltage of the Root-Mean-Square (RMS) between 10 percent and 90 percent, typically somewhere in the range of 0.5 and 10 cycles [23]. The terminology used to describe the voltage sag's magnitude is often confusing. A " 20 percent sag " may refer to a sag resulting in 0.8 pu or 0.2 pu voltage. When describing rms variations, the preferred terminology is retained voltage or the remaining voltage. Voltage sags are caused by short circuit miscues [8]. Voltage lists are generally identified with framework disappointments, yet can likewise be caused by substantial burdens or vast motors. Exchanging occasions on huge motors, jolt stroke and transmission disappointments can likewise prompt this issue. These occasions can prompt the shutdown of intensity plants and lead to misfortunes in influence plants [24][25]. Voltage drops can likewise be caused by vast changes in load or by the beginning of substantial motors. An acceptance engine can draw its full load current six to multiple times amid start-up.

This high current causes a voltage drop through the framework's impedance. On the off chance that the present extent with respect to the accessible framework blame current is substantial, the subsequent voltage outline might be noteworthy.

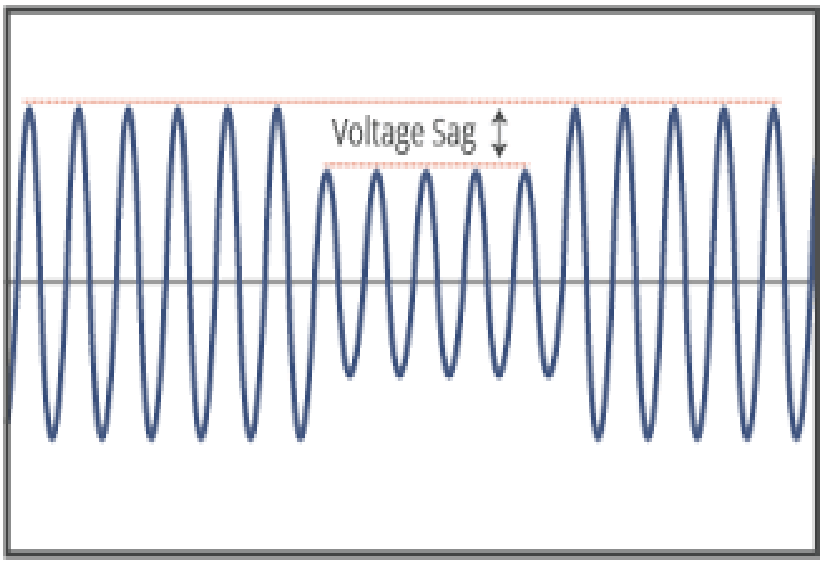

Figure 2-1: Voltage Sag

The term sag has for some time been utilized in the power quality network to depict a decrease in momentary voltage. The thought is clearly obtained straightforwardly from the word droop's exacting definition. Although not formally defined in the authoritative dictionary, the term used in the power quality community. Utilities, manufacturers and end - users have increasingly been accepted and used. In this phenomenon the IEC definition is dip. The two terms are viewed as exchangeable with list being favoured in the power quality network in North America.

2.3.1.3 Voltage Swells

The voltage swell is an increase in the RMS voltage from 1.1 per unit to 1.8 per unit, maintaining a period of 0.5 to 1 minute [23]. Typical magnitudes range from 1.1 pu to 1.2 pu. The magnitude of the swell is also described by the remaining voltage and therefore always exceeds 1.0 pu. The voltage swells also relate to the short circuit failures of the power system. Voltage swelling can be created by overloading and so on [18]. Swells are typically connected with framework disappointment conditions, similarly as with lists, however they are significantly less normal than voltage disappointments. A SLG disappointment on the framework can cause a swell, prompting a brief increment in voltage in the unfailing stages.

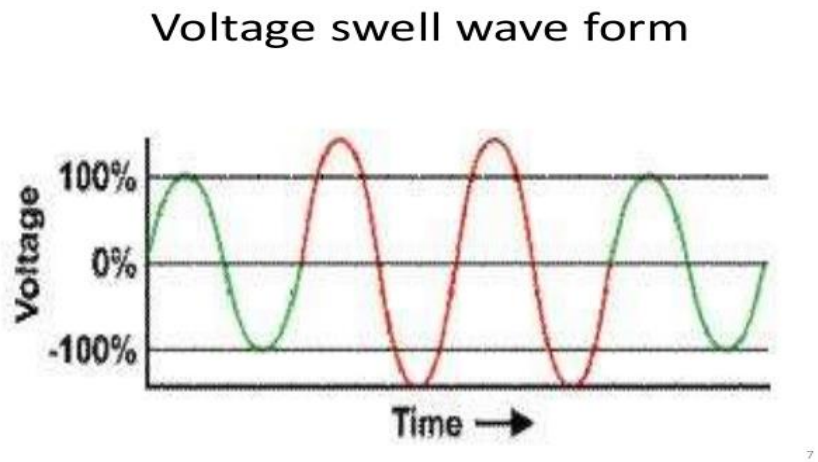

Figure 2-2: Voltage Swell

Swells have their greatness (rms esteem) and their term. The seriousness of a voltage swell amid an imperfection condition relies upon the area of the deformity, impedance of the framework and establishing. On an ungrounded framework, the line-to-ground voltages on the unfaulted stages will be 1.73 pu amid a line-to-ground blame condition. In the region of the substation on a proficiently grounded framework, there will be no voltage increment in the unfailing stages in light of the fact that the substation transformer is normally delta-wye associated and gives a low impedance zero-arrangement way for the blame current. Some of