Cairo University

FALSE TRIPS IN GAS POWER PLANT DUE TO TRANSIENT VOLTAGE VARIATION

By

Eng. Mahmoud Ismail Mehanna

A thesis submitted to the
Faculty of engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of

MASTER OF SCIENCE

In

Electrical Power and Machines Engineering

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Electrical Power Department

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Title of Thesis:

FALSE TRIPS IN GAS POWER PLANT DUE TO TRANSIENT VOLTAGE VARIATION

Key Words:

Combined Cycle, Sensitive Loads, Unbalance, Electrical Grid, Voltage Variations.

Summary:

The sudden isolation of a large combined cycle power plant in Al-Burullus, Kafr El-Sheikh city, Egypt with a capacity of 4800 MW will lead to a defect in the electric grid stability. This sudden isolation occurs due to Trip important sensitive loads in the Gas station of this plant (Fuel Gas Compressors and Auxiliary air compressor).

This thesis presents some of the published researches for power conditioning devices used for compensating the voltage fluctuation problem. (DVR) was selected to monitor the source voltage of these sensitive loads and compare it with the reference voltage. If any voltage drop is detected, this value is injected into the load side.

MATLAB/Simulink program is used to verify the effectiveness of this device in the compensation of the voltage sag with these loads in a duration less than 10msec. which is less than the trip setting of the load C.B.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

Name: Mahmoud Ismaiel Mehanna Date: / / 2019

Signature:

Dedication

I wish to express my deepest appreciation to my family,

especially to my parents and my sister Nahla for their unconditional support,

and love throughout my life.

And a special thanks for my lovely fiancée Rehab (my future wife), God willing for her continuous support to me and love.

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Table of Contents

Disclaimer ..... **I**
Dedication ..... **II**
Acknowledgements ..... **III**
List of Figures ..... **VII**
List of Tables ..... **IX**
List of Appendices ..... **X**
Nomenclature ..... **XI**
Abstract ..... **XIII**
Chapter 1. Introduction **1**
1.1 Background 1
1.2 Power Plant Arrangement 1
1.2.1 Shaft Sealing System: 3
1.2.2 Electrical Connections. 5
1.3 Sensitive Loads Ratings: 8
1.4 Voltage Variations 8
1.5 Problem Formulation 9
1.6 What is DVR? 10
1.7 The DVR System Connection. 10
1.8 DVR Power Circuit Components. 12
1.8.1 DC-Energy Storage Unit. 12
1.8.2 DC – AC Inverter: 12
1.8.3 Voltage Injection Transformer: 12
1.8.4 By-Pass Switch: 13
1.9 Thesis's Organization 13
Chapter 2. Literature Review **15**
2.1 Introduction 15
2.2 Power Conditioning Devices 15
2.3 Dynamic Voltage Restorer System (DVR) 16
2.3.1 Operating Principle of DVR 16
2.3.2 Performance of DVR 17

2.3.3 Survey on Control Strategies of the DVR Inverter. 18
2.3.4 Control Strategies of the DVR Rectifier. 20
2.3.5 Compensation Technique of DVR System 20
2.3.6 Voltage Sag Detection Techniques 22
2.4 Static Var Compensator (SVC): 23
2.5 Superconducting Magnetic Energy Storage (SMES): 24
2.6 PWM-Switched Autotransformer Technique: 27
2.7 Uninterrupted Power Supply (UPS): 28
2.8 Different Applications of the DVR System 31
2.9 Selection of Power Conditioning Device 32
2.10 Storage Method 32
2.11 Conclusion. 35
Chapter 3. Case Studies of Sensitive Loads 36
3.1 Introduction. 36
3.2 Voltage Variations Trends. 37
3.2.1 Case 1: First Voltage Variation Trends. 37
3.2.2 Case 2: The Second Voltage Variation Trend. 40
3.2.3 Case 3: The Third Voltage Variation Trend. 43
3.3 Sizing the Required Power Conditioning Device. 45
3.3.1 DVR System Sizing and Connection. 45
3.3.2 UPS System Sizing and Connection. 50
3.4 Summary 51
Chapter 4. Modeling and Simulation Results 53
4.1 DVR Model Components. 54
4.2 Simulation Results 57
4.2.1 Normal Operation Mode for both Loads. 57
4.2.2 Studying the Voltage Sag for MV FG Compressor: 59
4.2.3 Studying the Voltage Sag for LV Aux. Air Compressor: 64
4.2.4 Studying the Voltage Swell for MV Fuel Gas Compressor 66
4.2.5 Studying the Voltage Swell for LV Aux. Air Compressor: 68
4.3 Conclusion. 69
Chapter 5. Conclusions and Future Works 72
5.1 Conclusions: 72
5.2 Main Features of the Proposed Scheme 72

5.3 Suggestions for Future Work.....73
References.....74
Appendices.....79

List of Figures

Figure 1-1: Al-Burullus Power Plant Arrangement 2
Figure 1-2: Arrangement of the Fuel Gas Compressors Station 3
Figure 1-3: Single Stage Fuel Gas Compressor Seal 3
Figure 1-4: Fuel Gas Compressor Sealing Chamber 4
Figure 1-5: Configuration of Al-Burullus Combined Cycle Power Plant 5
Figure 1-6: Electric Part for One Module 6
Figure 1-7: Location of Senstive Loads in Al-Burullus Power Plant 6
Figure 1-8: SLD for Medium Voltage and Low Voltage Busbars 7
Figure 1-9: Fault Location on the Utility Power System 9
Figure 1-10: Compensation Technique Using DVR 10
Figure 1-11: Diagram of Series and Parallel DVR System 11
Figure 1-12: DVR Power Circuit Components 12
Figure 1-13: Injection Transformer Connected in Star/Open 13
Figure 2-1: Simple Series DVR Connection 16
Figure 2-2: Inverter Control Strategy of DVR 18
Figure 2-3: Pre-sag compensation technique 21
Figure 2-4: In-Phase Compensation Technique 21
Figure 2-5: Energy Optimization Technique 22
Figure 2-6: SVC Circuit 23
Figure 2-7: SMES System Components 25
Figure 2-8: PWM Auto-transformer Circuit 27
Figure 2-9: Online UPS System 29
Figure 2-10: Standby UPS 30
Figure 2-11: Line Interactive UPS 30
Figure 2-12: Standby-Ferro UPS 31
Figure 3-1: SLD for the Location of the AAC and FGC with a Fault in the TL 37
Figure 3-2: FG Compressor Trip Due to the Second Sag 39
Figure 3-3: Location of the Faulty Isolator with the Sensitive Loads 41
Figure 3-4: FGC and AAC Trip Caused by Voltage Sag 42
Figure 3-5: FGC and AAC Trip Caused by Transient Active Power Disturbance 44
Figure 3-6: DVR Connected with FGC and AAC 46
Figure 3-7: Lead acid Battery Self Discharge Rate 48
Figure 3-8: Lead acid Battery Cycle Life with DOD at (20°C) 50
Figure 3-9: UPS Connection as a Power Conditioning Device 51
Figure 4-1: Electrical Circuit with DVR 53
Figure 4-2: The circuit for the DVR with its control circuit 53
Figure 4-3: Three Phase DVR System with Sensitive Loads 54
Figure 4-4: Step Response of PID Controller 56
Figure 4-5: V_{Source} Constant & DVR in Standby Mode. 58
Figure 4-6: VSource Constant & DVR in Standby Mode 58
Figure 4-7: V_{load} Constant & DVR in Standby Mode. 58
Figure 4-8: Case No.1 MV Dropped but DVR Compensate the Sag 60
Figure 4-9: Case No.1 Three Phase Waveform of the Voltage Source Transient Drop 60
Figure 4-10: Case No.1 Load Voltage Restored after Adding the DVR System 60

Figure 4-11: Case No.2 MV Dropped but DVR Compensate the Sag in Load Side. .. 61
Figure 4-12: Case No.2 Three Phase Waveform of the Voltage Source Drop. 62
Figure 4-13: Case No.2 Load Voltage Restored after Adding the DVR System..... 62
Figure 4-14: Case No.3 MV Dropped but DVR Compensate the Sag in Load Side. .. 63
Figure 4-15: Case No.3 Three Phase Waveform of the Voltage Source Drop. 63
Figure 4-16: Case No.3 Load Voltage Restored after Adding the DVR System..... 64
Figure 4-17: Case No.2 LV Dropped but DVR Compensate the Sag in Load Side..... 64
Figure 4-18: Case No.2 Three Phase Waveform of the Voltage Source Drop. 65
Figure 4-19: Case No.2 Load Voltage Restored after Adding the DVR System..... 65
Figure 4-20: Case No.3 LV Dropped but DVR Compensate the Sag in Load Side..... 66
Figure 4-21: Case No.3 Three Phase Waveform of the Voltage Source Drop. 66
Figure 4-22: Case No.3 Load Voltage Restored after Adding the DVR System..... 66
Figure 4-23: MV Raised but DVR Consume the Swell in Load Side. 67
Figure 4-24: Three Phase Waveform of the Voltage Source Swell. 67
Figure 4-25: Load Voltage Restored after Adding the DVR System..... 68
Figure 4-26: LV Raised but DVR Consume the Swell in Load Side. 68
Figure 4-27: Three Phase Waveform of the Voltage Source Swell. 69
Figure 4-28: Load Voltage Restored after Adding the DVR System..... 69

List of Tables

Table 1-1:IEEE definition of the V_{sag} and V_{swell} 8
Table 2-1: Comparison Between FACTS Transmitting Time 34
Table 2-2: Comparison Between Different Storage Methods..... 34
Table 3-1: Trip Values for MV FG Compressor from Plant Curves 52
Table 3-2: Trip Values for LV Auxiliary Air Compressor from Plant Curves..... 52
Table 3-3: Non-Trip Values for MV FG Compressor from Plant Curves..... 52
Table 3-4: Non-Trip Values for LV Auxiliary Air Compressor from Trends..... 52
Table 4-1: FGC Voltage after Adding DVR System 70
Table 4-2: Auxiliary Air Compressor Voltage after Adding DVR..... 71

List of Appendices

Appendix A: Auxiliary Air Compressor Name Plate 79
Appendix B: Fuel Gas Compressor Driving Motor Name Plate 79
Appendix C: BP5-12-T2 12V / 5Ah Lead-Acid Battery Discharge Curve 79
Appendix D: BP5-12-T2 12V/5Ah Battery Specifications 79
Appendix E: RLC Block Parameters 80
Appendix F: PID Controller Parameters 80
Appendix G: Closed Loop Snapshot Linearization 81

Nomenclature

Symbols	Description
a	: Auto-transformer Turns Ratio
C	: Capacitance
D	: Diode
I_{AAC}	: Auxiliary Air Compressor Current
I_{FGC}	: Fuel Gas Compressor Current
I_L	: Auto-transformer Low voltage side
I_H	: Auto-transformer High voltage side
K_P	: Proportional Constant
K_I	: Integral Constant
M	: Motor
N	: Nitrogen
N_1	: Auto-transformer Low voltage side
N_2	: Auto-transformer High voltage side
$P_{DVR\ o/p}$	: Active Power Produced by DVR
R	: Resistance
S	: Apparent Power
S_1	: First Detected Sag
S_2	: Second Detected Sag
$V_{Ref.}$	: Reference Voltage
$V_{Pre\text{-}Fault}$	: Pre-fault Voltage
V_{Sag}	: Voltage During Sag Period
V_{DVR}	: The Injected Voltage Produced by DVR
$V_{Compensated}$	: The Load Voltage after adding the DVR
V_L	: Auto-transformer Low voltage side Voltage
V_H	: Auto-transformer High voltage side Voltage
V_{Source}	: Source Voltage
$V_{Pre\text{-}Sag}$	: Pre-Sag Voltage
$V_{RMS\text{-}Supply}$	: Root Mean Square Supply Voltage
V_{abc}	: Three Phase Voltage
V_{dq}	: Two-Dimension Voltage
V_{Load}	: Load Voltage
$V_{P.P.}$	: Peak to Peak Voltage
$V_{Thy.}$	: Thyristor Voltage
VA	: Volt Ampere
V_L	: Line Voltage
V_P	: Primary Voltage
V_S	: Secondary Voltage
Θ	: Power Factor Angle