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Voltage stability improvement of distributed generation

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Abstract: *This Paper presents an analysis of voltage stability in distribution systems, in the presence of distributed generation (DG). This paper include Steady state voltage and current and load Flow steady for reduce loss in power distribution system. In this paper included result of Matlab model and MIPower Experiments for voltage stability improvement of Distributed Generation. IN this paper mainly the focus is to minimize the power losses so that the voltage stability of distributed generation improved as a result.*
Keywords: *Distributed Generation, Radial Distribution Network, Voltage Stability,Dynamic stability, Electromagnetic Transient, Relay Coordination, Reliability, and Transient Stability etc.*

Nomenclature

P_{TL} total power loss
P_{La} total power loss due to active component of current
P_{Lr} total power loss due to reactive component of current
I_a active branch current
I_r reactive branch current

Abbreviations

AND active distribution network
DG distributed generator
RDN radial distribution network
T&D transmission and distribution
VSI voltage stability index
PLI power loss index
DGSI distributed generator suitability index
Δ small change in variable

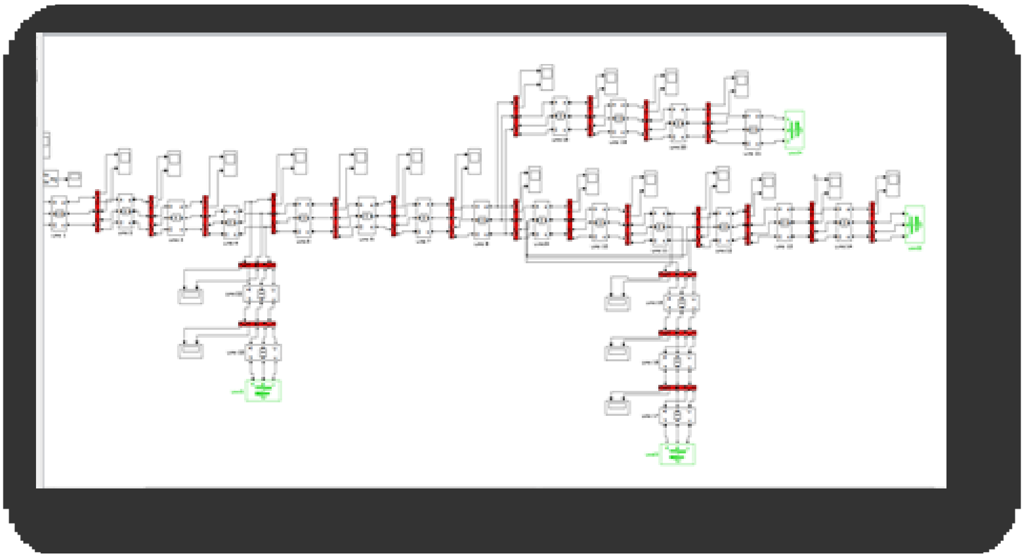
Subscript

I node

I. Introduction

These Paper present Voltage stability improvements in Distributed Generation using different-different type methodology .In this paper we analysis MAT LAB Simulink Model for DistributedGeneration system. In this model we used four load(4 load), and 21 buses ,DG source .In this model we arranged the loads connecting with buses which occurs low power losses .we used here three source(A,B,C).

In this paper also included analysis of Power Distributed generation using MI Power experiments .Here we used different –different type method for analysis for power losses in Distributed Generation System .Dynamic stability method we used 4 number of generators ,4 number of voltage regulators , 3 number of governors for analysis. Electromagnetic Transient method we analysis load flow by Gauss-Siedel Method. Relay Coordination method we used Over Current Relay Co-ordination for analysis DG.Reliability in this method we analysis output for DG. Transient Stability we analysis load flow by Newton Rapshon Method.



II. Load Flow Study

A power flow study (load-flow study) is a steady-state analysis whose target is to determine the voltages, currents, and real and reactive power flows in a system under a given load conditions. Basically Newton-Raphson and Gauss-Seidel methods are used for load flow study but now it become incompetent due to such factors radial structure, high ratio of resistance and reactance and unbalanced loads and many other factors.

III. Methodology

The total power loss in a distribution system having ‘n’ number of branches is given by

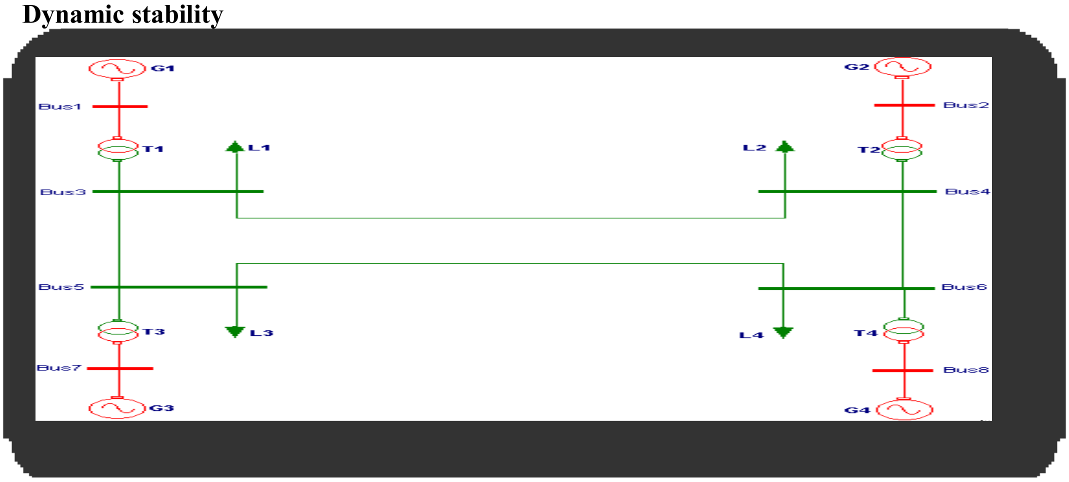
$$\mathbf{P_{TL}} = \sum_{I=1}^{n} \mathbf{I_i}^2 \, \mathbf{R_i} \qquad (1)$$

I_i is the current magnitude and R_i is the resistance. $\mathbf{I_i}$Can beobtained from load flow study. Thebranch current has twocomponents, active component Ia and reactive component Ir .
The total losses associated with these two components can bewritten as

$$\mathbf{P_{TL}} = \mathbf{P_{La}} + \mathbf{P_{Lr}} \qquad (2)$$

$$\mathbf{P_{TL}} = \sum_{i=1}^{n} \mathbf{I_{ai}}^2 \mathbf{R_i} + \sum_{i=1}^{n} \mathbf{I_{ri}}^2 \, \mathbf{R_i}(23)(3)$$

1.1. Dynamic stability



DYNAMIC STABILITY STUDIES
SCHEDULE NO: 0 CONTINGENCY NO: 0 CONTINGENCY NAME: Base Case

Total number of generators : 4
Total number of voltage regulators : 4
Total number of governors : 3

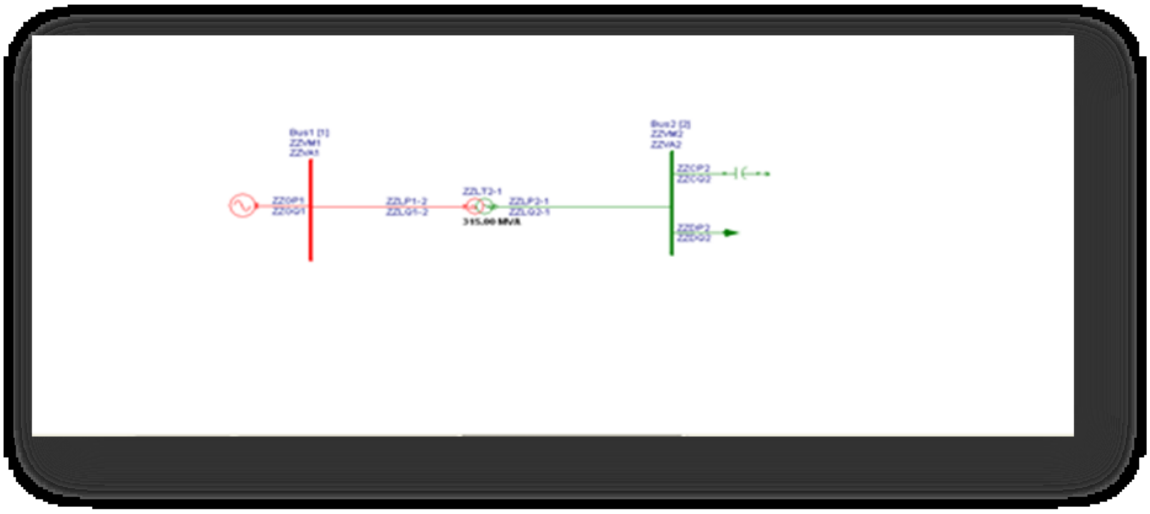
Total number of static var compensators: 0
Swing bus considered for the study : 1
Data output option : 1

Number of variables for plot : -1
Plot interval (multiple of time step) : 10
Base MVA : 100.000
Nominal System Frequency: 50.000 Hz
Total study time : 5.000 seconds
Time step for the study: 0.005 seconds

Machine number where disturbance is considered: 2
Change in generator reference angle : 0.00000
Change in generator reference voltage : 0.50000
Change in generator reference power : 0.00000
Change in svc reference : 0.00000

Bus No	Status	Zone	Volt-KV	Name	V-pu(mag)	V-deg(ang)	Pgen	Qgen
					Pl-MW	Qi-MVAR	Qc-MVAR	
1	1	1	11.000	Bus1	0.00001	21032042.00000	71.460	0.000
					0.00000	0.000	0.000	
2	1	1	11.000	Bus2	0.00001	30174136.00000	153.000	0.000
					0.00000	0.000	0.000	
3	1	1	11.000	Bus7	1.00000	0.00000	71.590	1431.500
					0.00000	0.000	0.000	
4	1	1	11.000	Bus8	0.00001	22731398.00000	80.000	0.000
					0.00000	0.000	0.000	

1.2. Electromagnetic Transient:



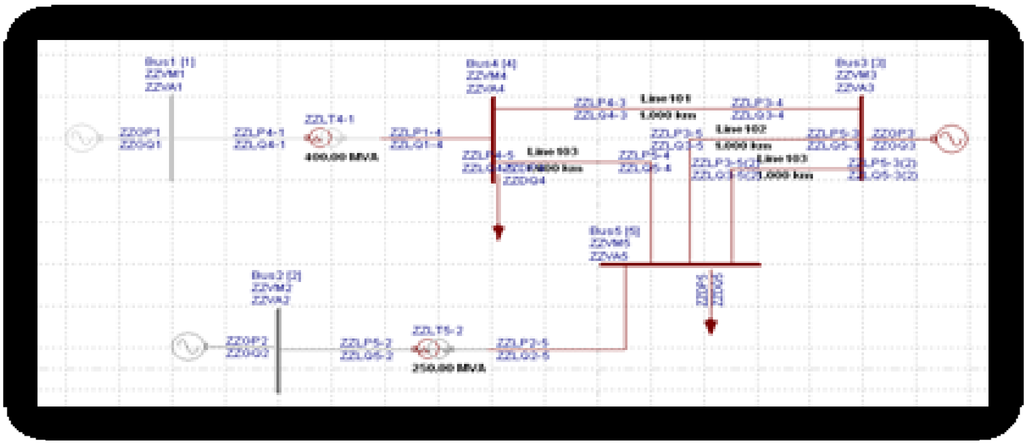
LOAD FLOW BY GAUSS-SIEDEL METHOD
CASE NO: 1 CONTINGENCY:0 SCHEDULENO: 0
CONTINGENCY NAME: Base Case RATING CONSIDERED: NOMINAL

LARGEST BUS NUMBER USED : 2 ACTUAL NUMBER OF BUSES : 2
NUMBER OF 2 WIND TRANSFORMERS: 1 NUMBER OF 3 WINDTRANSFORMERS: 0
NUMBER OF TRANSMISSION LINES : 0
NUMBER OF SERIES REACTORS : 0 NUMBER OF SERIES CAPACITORS : 0
NUMBER OF CIRCUIT BREAKERS : 0
NUMBER OF SHUNT REACTORS : 0 NUMBER OF SHUNT CAPACITORS : 1
NUMBER OF SHUNT IMPEDANCES : 0
NUMBER OF GENERATORS : 1 NUMBER OF LOADS : 1
NUMBER OF LOAD CHARACTERISTICS: 0 NUMBER OF UNDER FREQUENCY RELAY: 0

NUMBER OF GEN CAPABILITY CURVES: 0 NUMBER OF FILTERS : 0
NUMBER OF TIE LINE SCHEDULES : 0
NUMBER OF CONVERTORS : 0 NUMBER OF DC LINKS : 0
NUMBER OF SHUNT CONNECTED FACTS: 0
POWER FORCED LINES : 0

NUMBER OF TCSC CONNECTED : 0
NUMBER OF SPS CONNECTED : 0
NUMBER OF UPFC CONNECTED : 0

3.3:Transient Stability



LOAD FLOW BY NEWTON RAPHSON METHOD
CASE NO: 1 CONTINGENCY:0 SCHEDULENO: 0
CONTINGENCY NAME: Base Case RATING CONSIDERED: NOMINAL

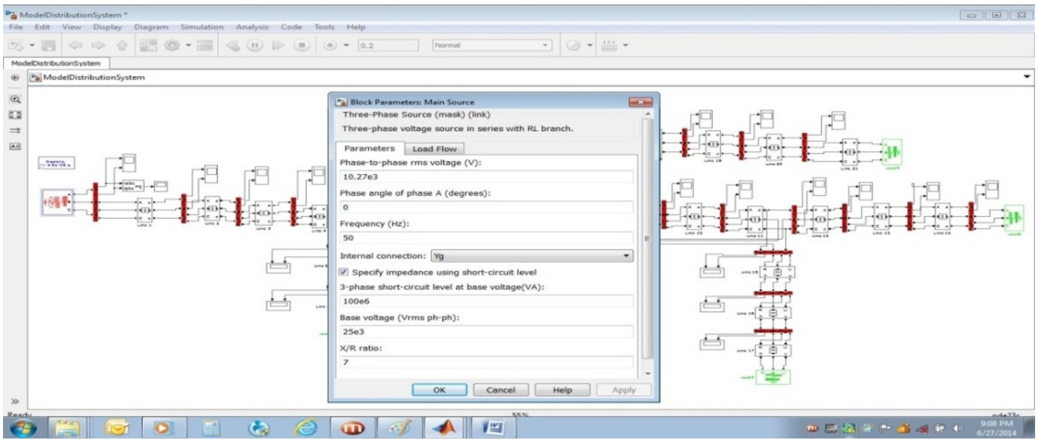
VERSION NUMBER: 7.3
%% First Power System Network
LARGEST BUS NUMBER USED : 5 ACTUAL NUMBERS OF BUSES : 5
NUMBER OF 2 WIND. TRANSFORMERS:2 NUMBERS OF 3 WINDS. TRANSFORMERS: 0
NUMBER OF TRANSMISSION LINES : 3
NUMBER OF SERIES REACTORS : 0 NUMBER OF SERIES CAPACITORS : 0
NUMBER OF CIRCUIT BREAKERS : 0
NUMBER OF SHUNT REACTORS : 0 NUMBER OF SHUNT CAPACITORS : 0
NUMBER OF SHUNT IMPEDANCES : 0
NUMBER OF GENERATORS : 3 NUMBER OF LOADS : 2
NUMBER OF LOAD CHARACTERISTICS: 0 NUMBER OF UNDER FREQUENCY RELAY: 0
NUMBER OF GEN CAPABILITY CURVES: 0 NUMBER OF FILTERS : 0
NUMBER OF TIE LINE SCHEDULES : 0
NUMBER OF CONVERTORS : 0 NUMBER OF DC LINKS : 0
NUMBER OF SHUNT CONNECTED FACTS: 0
POWER FORCED LINES : 0

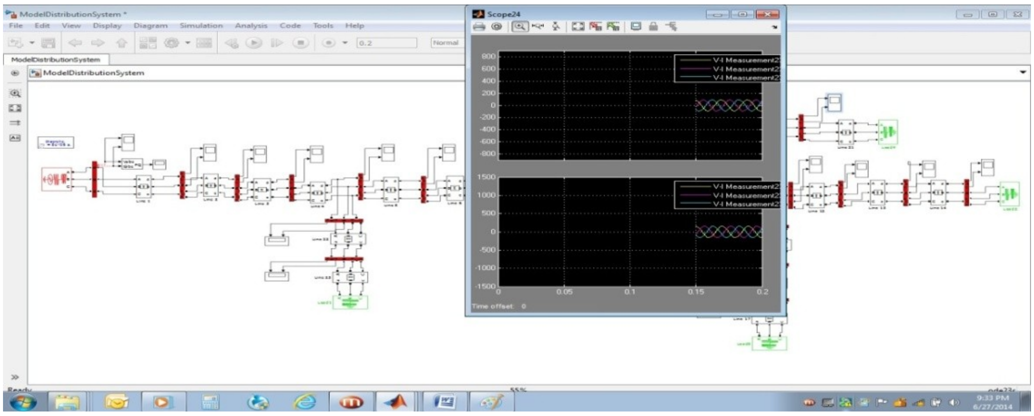
NUMBER OF TCSC CONNECTED : 0
NUMBER OF SPS CONNECTED : 0
NUMBER OF UPFC CONNECTED : 0

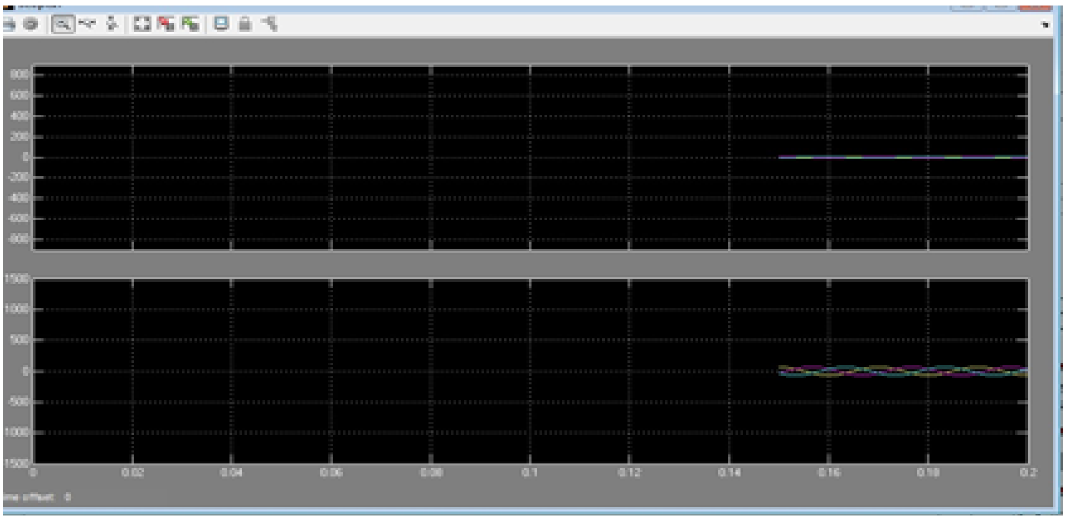
IV. Results

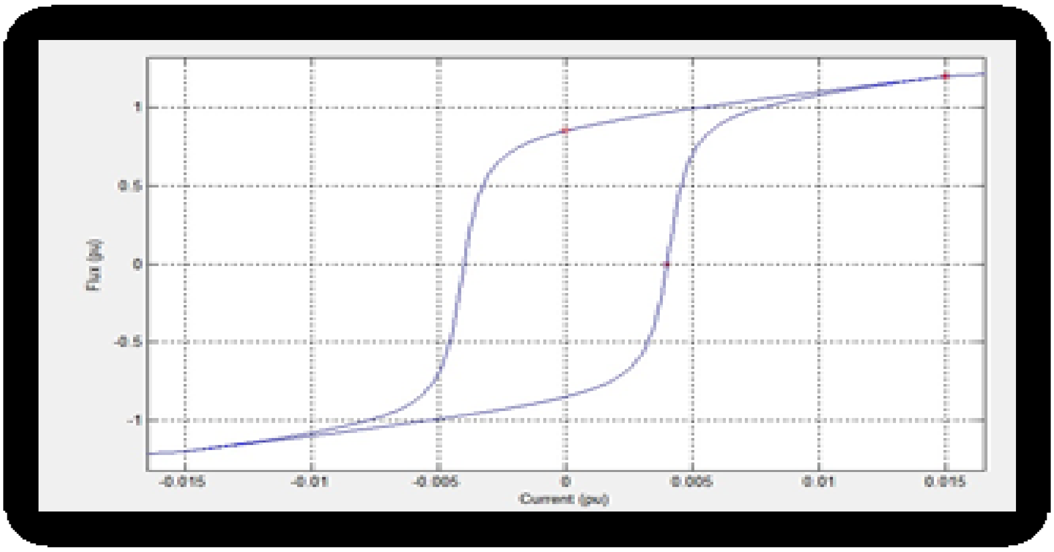
SOURCES:
1: 'U_A: Main Source' = 8385.42 V 0.00°
2: 'U_B: Main Source' = 8385.42 V -120.00°
3: 'U_C: Main Source' = 8385.42 V 120.00°
MEASUREMENTS:
1: 'U A: V-I Measurement9 ' = 521.80 V -70.50°

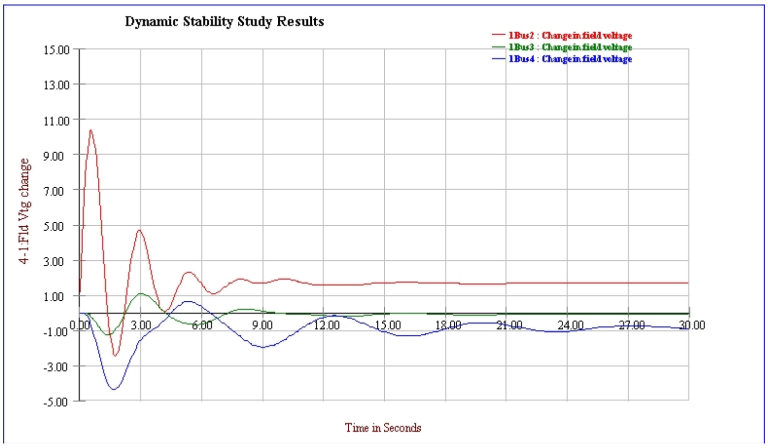
2: 'U B: V-I Measurement9 ' = 521.80 V 169.50°
3: 'U C: V-I Measurement9 ' = 521.80 V 49.50°
4: 'U A: V-I Measurement8 ' = 685.20 V -67.88°











V. Conclusion:

Sizing and Placement of DG make important role in Power Distributions Networks. This Paper we used different –different method of reduced Powerloss. We donethis type of Sizing and placement of which is stabilized Voltage. We done this simulation for Geranial type of Power distributions networks .Relays, Junction Box and Type of Load also effects power output .According to Power distribution Network power loses are increased. In futures we can done more reduction in Power losses by improving method of sizing, placing and quality of junction box. Also make it cost effective.

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