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FAULT DETECTION BASED ON IMPEDANCE VALUES FOR THE DISTRIBUTED GENERATING SYSTEM

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ABSTRACT

This main objective of the project is to identify the fault occurring in the grid connected distributed generating system and also isolates the particular affected areas. To deliver the power to the customer in an efficient manner the impedance values are should maintain at a constant level. If the impedance value of any one of DG's are varies, it affects the entire grid connected systems. This method is based on injecting two non-characteristics harmonic currents to the grid and the appropriate harmonic voltages are developed at the Point of Common Coupling (PCC) and impedance is calculated. Newton Raphson method is involved for the impedance calculation. The work is carried out under the MATLAB Environment, the results are verified theoretically and by simulation

***Keywords**: fault, distributed generating systems, isolation, injection of fault, impedance.*

INTRODUCTION

The consumption of the electrical energy is increased day by day, so the demand in the electrical energy is increased in recent days. The non-renewable sources (thermal, nuclear & diesel) are not able to meet the entire load demand. To meet out the demand in the power system the non-renewable sources are arise. In the Distributed energy systems solar cells, windmills and the photo voltaic cells are the largest utilization nowadays. The power electronics devices are mostly used in all areas of the power system it affects the quality of electrical power and also creates faults. To prevent the grid connected system from the various faults an islanding situation is achieved the islanding situation in an easiest way and takes less amount of time.

To achieve the islanding situation passive methods (inverter resident method) if any power mismatch is occurred in the power system due to the variation in power system it is automatically disconnected. This method is normally easy to implement and the non-detection zones is very high are discussed in [1]. The islanding detection of multiple parallel connected inverter are isolated by introducing the high frequency signals. There are two types of inverter are employed for the islanding detection, they are master and slave inverter. The master inverter is used for injecting high frequency signals and the slave inverter is works in high frequency current cancellation mode. If any problem is occurred in the master inverter the remaining inverters are automatically assigning the role of master inverter [2]. The high frequency signal injection for the periodic variation in the converter output, which gives the variation between the voltage and the current from that the values the impedances are calculated and islanding is achieved. The two different high frequency signals are in the range of 75Hz and 400Hz are injected to the zero crossing of grid voltage [3]. The another method involved for the continuous signal injection to the grid and it also allowed the instantaneous detection of island[4], but this method is leads to increase the Total Harmonic Distortion (THD). To extract the voltage and the current signals from the Point of Common Coupling (PCC) the Autoregressive (AR) modelling are used. Then the Support Vector Machine (SVM) is used for achieving islanding state [5]. This islanding is occurs when a part of power system is accidently disconnected from the main grid while it is energized by the local Distributed Generations(DG's), no need to supervise the islanding system. In recent days the photovoltaic inverters are mostly used. In the photo voltaic isolation a Micro transformer is used [6], it have the primary and the secondary windings. It transfers the signals from one side to another side, the signals are transferred from the primary side to the secondary side. Before the signal transmission they are encoded at the primary side of the transformer, at the secondary's the transferred signals are decoded. The online method for detecting and locating a faulty areas in the utility grid for smart grid [7]. A high frequency (A-Band) current signals are vaccinates to the grid that carry out the harmonic voltage, the voltage are in the range of less than 1 volt. By comparing the voltage and current the impedance variation is calculated. This method is not affect the normal power flow, detection is achieved in online method. Three phase power factor correction rectifiers are used for the harmonic current injection [8]. In this method the harmonic current is generated by the only one switching leg. It need less amount of cost compared to the conventional six-arm pulse width modulation, the input current total harmonic distortion is 8.5% for the approximate load of 1 kW. The passive islanding detection methods are discussed in paper [9], a statistical signal processing algorithm is developed for the parameter estimation. The signal parameters are estimated with the help of rotational invariance technique and find the voltage and frequency at the point of common coupling. Cross validation was used to measure the performance of the islanding detection method. By exciting the LCL filter at the resonance (X_L=X_C) condition the impedance is calculated [10]. From that the impedance variation the islanding situation is obtained. The main drawback of the system is how to excite the system resonance in a controlled manner

II. EXISTING SYSTEM

To achieve the islanding situation they are find out the impedance value of the grid connected Distributed Generating systems. The harmonic current injection are used to find the impedance value of DG's and also helps to isolation. A small power three phase full bridge inverter is employed to inject the harmonic currents. It supplies two non-characteristics of harmonic current in the frequency range of 75Hz and 125Hz to the grid. And the appropriate harmonic voltage are developed at the PCC. Three impedances are connected in series to output of the inverter it stimulates the grid condition. The current and the voltage references are taken from the voltage lines for the calculation of impedances. The ADC is used for convert the analog signal into digital signal which is suited for the impedance calculation. A Discrete Fourier Transform (DFT) is used for the impedance calculation by comparing the voltage and the current references the impedance vales are detected. Then it sent to the power converter for the islanding.

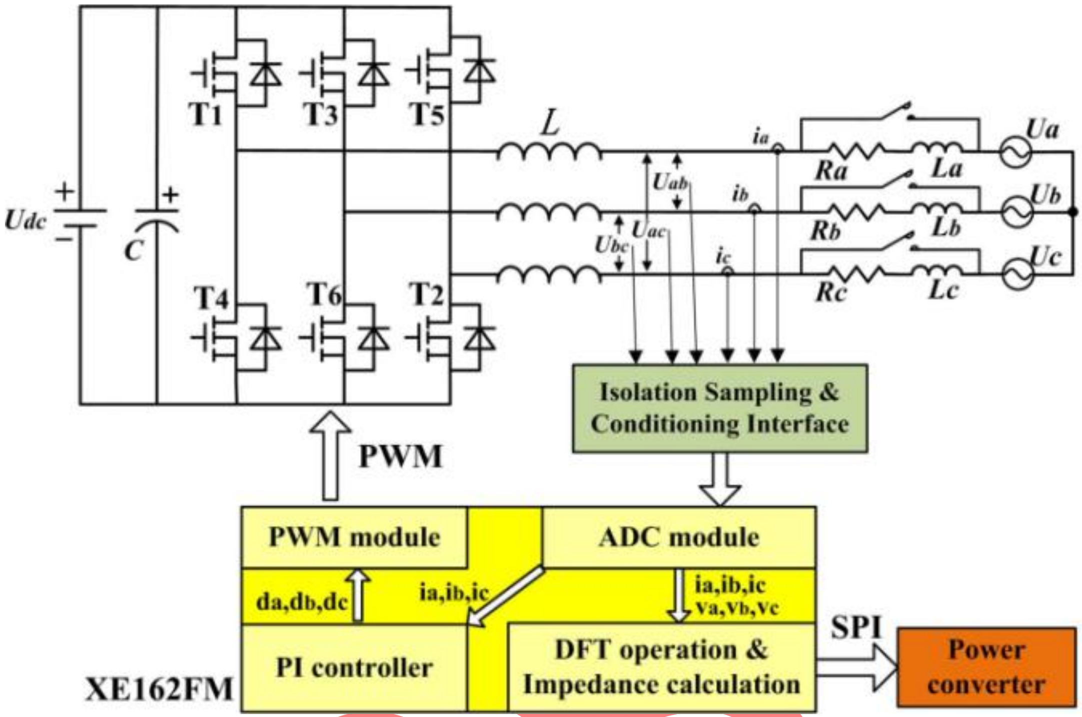


Figure.1 Existing System

A 500-VA three-phase full-bridge inverter is employed to inject the harmonic currents. Both the conventional method and modified one are realized with experiments. The laboratory prototype is shown in Figure. 1. Three impedances are series connected with voltage sources to simulate the grid conditions. The utility three phase grid is not suitable for clarifying the proposed method because the grid-connected sources and loads are uncertain and the grid impedances changes randomly. Three L filters are utilized and the inductor values are all 50 mH. The DC bus voltage is chosen 700 V and the capacitor in the DC bus is 340 uF to keep the inverter operate smoothly. The sampling frequency and the discrete control frequency are both chosen 18-kHz which is much higher than the fundamental frequency 50-Hz and the injected harmonic currents frequencies 75-Hz, 125-Hz, which insured the output current quality and the accuracy of DFT operation.

III . PROPOSED SYSTEM

A synchronous machine is connected to an infinite bus through a transformer and a double circuit transmission line, as shown Figure.2. The infinite bus voltage V=1.0 p.u. The direct axis reactance of machine is 0.20 p.u, The transformer reactance is 0.10 p.u Reactance of each transmission line is 0.40 p.u, All to a base of rating of synchronous machine. Initially the machine is delivering 0.8 p.u power with terminal voltage of 1.05 p.u. The inertia constant H=5 MJ/MVA. All resistances are neglected. The equation of the machine rotor is to be determined.

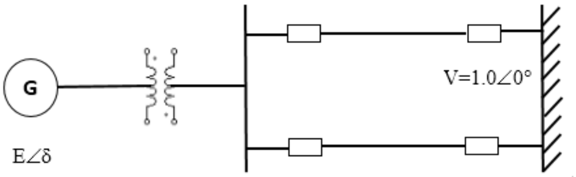


Figure.2 Example system

The electrical power is given by

$$P_e = P_1 = P_c + EVY_{12} sin\ (d-g)$$
$$= E\ V\ Y_{12} sind$$
$$= 2E\ sind \qquad (1)$$

Thus the internal machine voltage is

$$EĐd = 1.05\underline{|13.21^\circ} + (0.803\underline{|-5.29^\circ})\ (0.2\underline{|-90^\circ})$$
$$= 1.022 + j0.240 + 0.0148 + j\ 0.160$$
$$= 1.037 + j0.400$$

$$\mathbf{E\underline{|-d} = 1.111\underline{|-21.09^\circ} p.u}$$

The swing equation is given by

$$\frac{2H}{\omega_R}\frac{d^2\delta}{dt^2} = Pm - Pe$$

$$\frac{d^2\delta}{dt^2} = (0.8\ -2.22\ Sind)\ rad\ /\ s^2 \qquad (I)$$

ω_R -Provided by U.S – internal data for rotating machine in English unit. Moment of inertia will derived from mixture of MKS quantity.ω_R – Kinetic energy of rotating body– standard. Equation (I) we observe that resulting swing equation is non-linear. From Figure.3 fault is applied at the sending node 4 of the transmission line. Considered a three phase fault that presents balance impedance of j0.1 to Neutral.

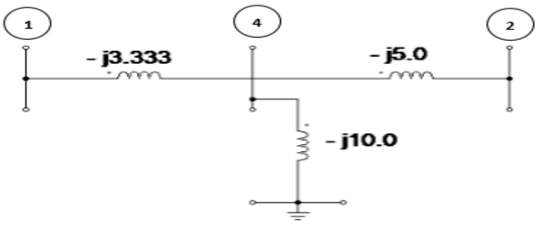


Figure. 3 Faulted network in terms of admittance

By Y-Δ transformation we compute

$$\overline{Y}_{12} = \text{-j [(3.333x5)/18.33] = -j0.909}$$

And since $\overline{Y}_{12} = -\overline{Y}_{12}$

Then $\overline{Y}_{12} = j0.909$

The electrical power output of the machine is now

$$P_e = (0.909 \times 1.1111) \sin\delta$$

$$= 1.010 \sin\delta$$

Equation of motion of rotor is

$$\frac{d^2\delta}{dt^2} = \frac{377}{10}\,\mathbf{(0.8 - 1.010\ \sin\delta)\ rad/s^2} \qquad \text{(II)}$$

At start of rotor of transient $\sin\delta_0 = 0.36$ and the initial rotor acceleration is given by

$$\frac{d^2\delta}{dt^2} = \frac{377}{10}\,[0.8 - (1.010 \times 0.368)]$$

$$\mathbf{= 16.45\ rad/s^2} \qquad \text{(III)}$$

Assume that after some time the circuit breaker at sending end of the faulted line clears the fault by opening that line. The network now will have a series reactance of j0.70 p.u (j0.20 + j0.10 +j0.40) and new network (with fault cleared) will have a new value of transfer admittance

$$\bar{Y}_{12} = j1.429 \text{ p.u}$$

The new swing equation will be

$$\frac{d^2\delta}{dt^2} = 37.7(0.8 - 1.587\sin\delta)\ \text{rad/s}^2 \qquad \text{(IV)}$$

(a)Fault Calculation

The equation for 'δ' were obtained in previous process. δ - function of time for the system. Assume fault is cleared in nine cycles (0.15s).

The non-linear equation is obtained in the previous steps, using numerical integration, the modified Euler method is used in this problem.

First, the swing equation is replaced by two first order differential equations

$$\delta = \omega(t) - \omega_R$$

$$\omega = (\omega_R / 2H)\,[P_m - P_e(t)] \qquad (2)$$

The time domain is divided in to increments called Δt. with values of δ and ω and their derivations known at some times t, an estimate is made of the values of these variables at the end of interval of time Δt, at time t +Δt. These are called predicted values of variables based only on values of δ(t) and ω(t) and their derivatives.

From the calculated values of δ(t +Δt) and ω(t +Δt) values of derivatives t+Δt are calculated. A corrected value of δ(t +Δt) and ω(t +Δt) is obtained using mean derivative over the interval the process can be repeated until a desired prediction is achieved. At the end of prediction and correction a final value of δ(t +Δt) and ω(t +Δt) is obtained.

Initial value of δ is Sin^{-1} 0.368 and the equation for ω is

$$\omega = 37.7(0.800 - 1.010\,Sin\delta) \quad 0 \le t \le 0.15 \qquad (IV)$$

$$= 37.7(0.800 - 1.587\,Sin\delta) \quad t \ge 0.15$$

IV EQUAL AREA CRITERION

Equal area criterion curve shown in Figure.4. Consider swing equation for a machine connected to an infinite bus derived previously in the form

$$\frac{2H}{\omega_R}\frac{d^2\delta}{dt^2} = Pm - Pe = Pa \qquad (p.u) \qquad (3)$$

Where Pa is accelerating power from equation (3)

$$\frac{d^2\delta}{dt^2} = \frac{\omega R}{2H}Pa \qquad (4)$$

Multiply each side by 2(dδ/dt)

$$2\frac{d\delta}{dt}\frac{d^2\delta}{dt^2} = \left(\frac{\omega R}{2H}\right)\mathbf{Pa}\left(2\frac{d\delta}{dt}\right)$$

$$\frac{d}{dt}\left(\frac{d\delta}{dt}\right)^2 = \left(\frac{\omega R}{2H}\right)Pa\left(2\frac{d\delta}{dt}\right) \qquad (5)$$

$$d\left(\frac{d\delta}{dt}\right)^2 = \frac{\omega R}{2H}Pa\,d\delta \qquad (6)$$

Integrating both sides

$$\left(\frac{d\delta}{dt}\right)^2 = \frac{\omega R}{H}\int_{\delta 0}^{\delta} Pa\,d\delta \qquad (7)$$

$$= \left(\frac{\omega R}{H}\int_{\delta 0}^{\delta} Pa\,d\delta\right)^{1/2} \qquad (8)$$

Equation (8) is the relative speed of m/c w.r.to reference frame moving at constant speed (by definition of angle δ).

For stability this speed must be zero when the acceleration is either zero or is opposing the rotor motion.

Thus for a rotor that is accelerating, the condition of stability is that a value δ_{max} exists such that

$$Pa\,(\delta_{max}) \le 0 \text{ and } \int_{\delta 0}^{\delta max} Pa\,d\delta = 0 \qquad (9)$$

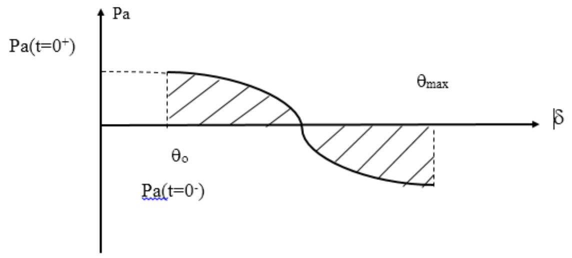


Figure. 4 . Equal Area Criterion Curver

(a)Critical Clearing Angle

For a system of one machine is connected to infinite bus and for a given fault and switching arrangement, the initial clearing angle is that the switching angle for which the system is at the edge of instability. The maximum δ_{max} corresponds to the angle of δ_m on the fault cleared angle.

Pm = peak of prefault power angle curve.

r_1 = ratio of power angle curve for fault network to Pm

r_2 = ratio of peak of power angle curve of network with fault cleared to Pm.

$$\left.\begin{aligned}\delta_o &= \sin^{-1} P_m/P_M < \pi/2\\ \delta_m &= \sin^{-1} P_m/P_M\ r_2 > \pi/2\end{aligned}\right\} \qquad (10)$$

Then for $A_1 = A_2$

And for critical clearing

$$\delta c = \cos^{-1}\{[1/r_2 - r_1]\,[(P_m/P_M)\,(\delta m - \delta o) + (r_2 \cos\delta m - r_1\ \cos\delta o)]\} \qquad (11)$$

(b)Equal Area Criterion for Two Machine System

Two machine system can be reduced to an equivalent system of one machine connected to an infinite bus

$$\int_{b120}^{b12}\left(\frac{Pa1}{H1}-\frac{Pa2}{H2}\right) d\,\delta_{12} = 0 \qquad (12)$$

Where $\delta_{12} = \delta_1 - \delta_2$

In special case where the resistance is neglected the equation (12) becomes,

$$\frac{1}{Ho}\int_{\delta 120}^{\delta 12} Pa1\ \ d\delta 12 = 0 \qquad (13)$$

Where

$$H_o = H_1 H_2 / (H_1 + H_2)$$

Assumption made:

a) Mechanical power input is constant
b) Damping or asynchronous power is negligible
c) Constant – voltage behind transient reactance model for synchronous machine is valid.
d) The mechanical rotor angle of machine coincides with angle of voltage behind transient reactance.
e) Loads are represented by passive impedance from the nine bus system.

V. RESULTS AND DISCUSSION

We discussed in earlier, introducing the three phase fault in the nine bus system Figure.5 and check the impedance value in interconnected bus node. Considered the fault occurs in bus 7 for t=0.15 s and the characteristics value of impedance are obtained through the power system analysis tool in Matlab Environment, observed waveform in P.U and obtained the fault impedance value and corrected impedance value after the fault cleared in the bus 7 for verifying the designed system.

From the power system analysis tool, four type of solver is available, we used Newton Raphson method for calculating the y-bus value after that we calculate the convergence error and verified the impedance value in theoretical calculation. Calculated power flow time shown in Figure.7(a-d).

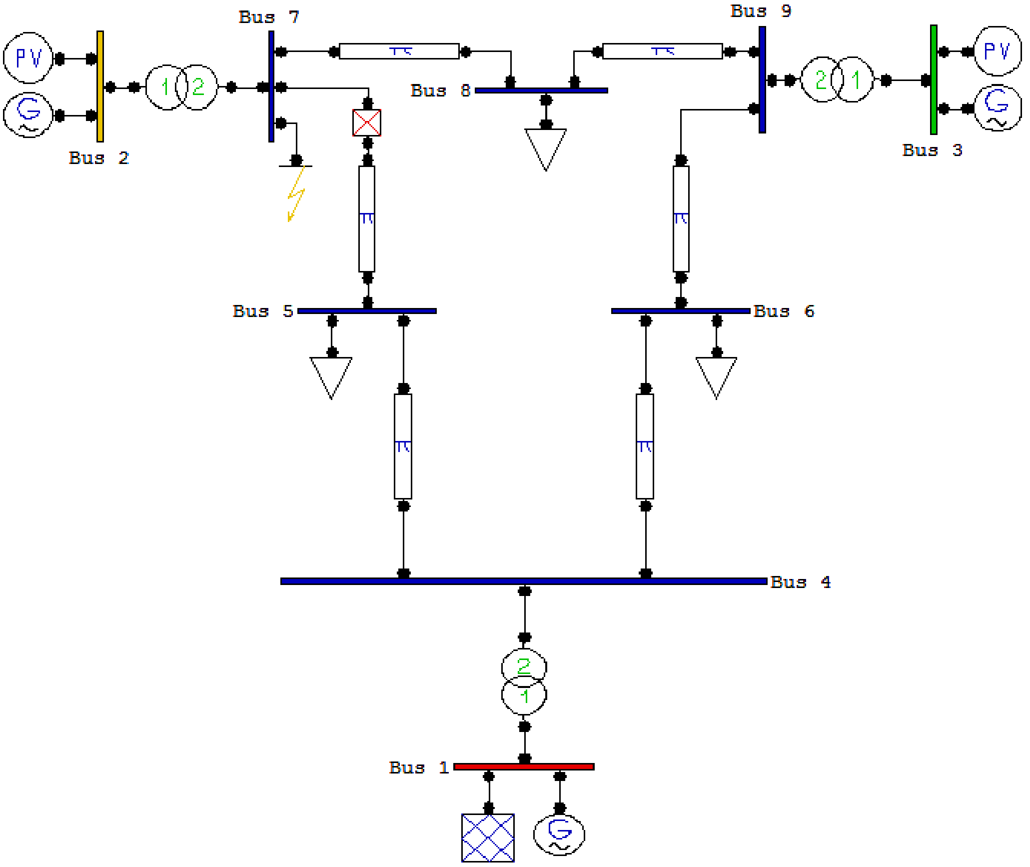


Figure.5 simulation model

Power Flow Analysis

Final simulation time "tf" set to 1.8424 s

Newton-Raphson Method for Power Flow Computation

Writing file "fm_call" ...

PF solver: Newton-Raphson method

Single slack bus model

Iteration = 1 Maximum Convergency Error = 0.17263

Iteration = 2 Maximum Convergency Error = 0.012643

Iteration = 3 Maximum Convergency Error = 0.00017163

Iteration = 4 Maximum Convergency Error = 4.1876e-008

Initialization of Synchronous Machines completed.

Power Flow completed in 0.05 s

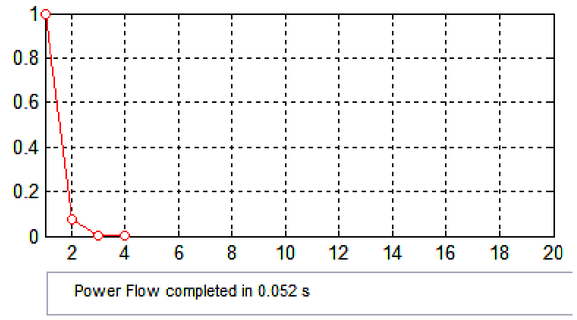


Figure 6(a): NR Method

PF solver: XB fast decoupled method

Single slack bus model

Iteration = 1 Maximum Convergency Error = 0.93842

Iteration = 2 Maximum Convergency Error = 0.011607

Iteration = 3 Maximum Convergency Error = 0.00018908

Iteration = 4 Maximum Convergency Error = 7.8476e-006

Initialization of Synchronous Machines completed.

Power Flow completed in 0.049 s

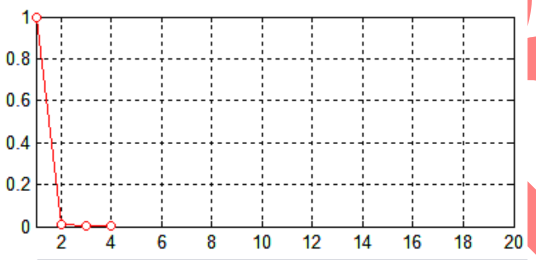


Figure 6(b): XB fast decoupled method

PF solver: Runge-Kutta method

Single slack bus model

Iteration = 1 Maximum Convergency Error = 0.10294

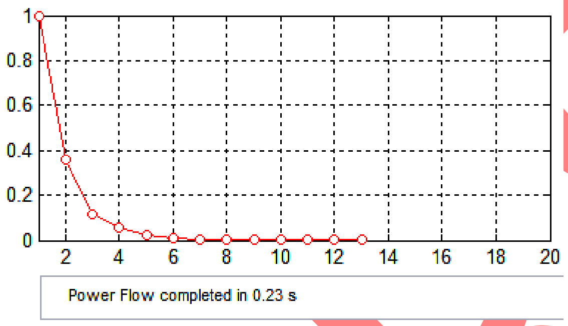
Iteration = 2 Maximum Convergency Error = 0.036751

Iteration = 3 Maximum Convergency Error = 0.011736

Iteration = 4 Maximum Convergency Error = 0.0055474

Iteration = 5 Maximum Convergency Error = 0.0026266

```
Iteration = 6     Maximum Convergency Error = 0.0012446
Iteration = 7     Maximum Convergency Error = 0.00058992
Iteration = 8     Maximum Convergency Error = 0.00027966
Iteration = 9     Maximum Convergency Error = 0.00013258
Iteration = 10     Maximum Convergency Error = 6.2859e-005
Iteration = 11     Maximum Convergency Error = 2.9802e-005
Iteration = 12     Maximum Convergency Error = 1.413e-005
Iteration = 13     Maximum Convergency Error = 6.6992e-006
Initialization of Synchronous Machines completed.
Power Flow completed in 0.23 s
```



Power Flow completed in 0.23 s

Figure 6(c): Runge-Kutta method

PF solver: Robust power flow method

```
Single slack bus model
Iteration = 1     Maximum Convergency Error = 0.17263
Iteration = 2     Maximum Convergency Error = 0.012643
Iteration = 3     Maximum Convergency Error = 0.00017163
Iteration = 4     Maximum Convergency Error = 4.1876e-008
Initialization of Synchronous Machines completed.
Power Flow completed in 0.05 s
```

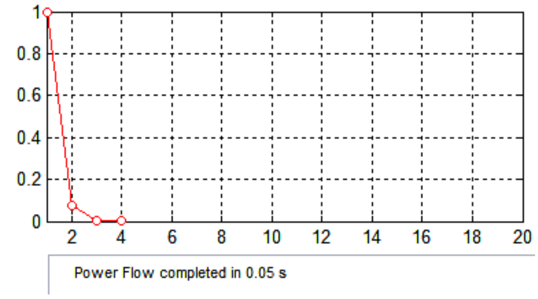


Figure 6(d): Robust power flow method

Continuation Power Flow - Single Slack Bus

Corrector Method: Perpendicular Intersection

Check Voltage Limits: No

Check Generator Q Limits: No

Check Flow Limits: No

Point = 1 lambda = 0 kg = 1.9994

Point = 2 lambda = 0.14189 kg = 1.7177

Point = 3 lambda = 0.28237 kg = 1.4382

Point = 4 lambda = 0.42121 kg = 1.1615

Point = 5 lambda = 0.55816 kg = 0.8879

Point = 6 lambda = 0.69286 kg = 0.6182

Point = 7 lambda = 0.82481 kg = 0.35324

Point = 8 lambda = 0.95334 kg = 0.09427

Point = 9 lambda = 1.0775 kg =-0.1569

Point = 10 lambda = 1.1958 kg =-0.39751

Point = 11 lambda = 1.3058 kg =-0.62318

Point = 12 lambda = 1.4038 kg =-0.82653

Point = 13 lambda = 1.483 kg =-0.99459

Point = 14 lambda = 1.5319 kg =-1.105

Point = 15 lambda = 1.5353 kg =-1.1275

Point = 16 lambda = 1.4875 kg =-1.0486

Point = 17 lambda = 1.4025 kg =-0.89433

```
Point =  18  lambda = 1.2979      kg =-0.69914
Point =  19  lambda = 1.184      kg =-0.48354
Point =  20  lambda = 1.0658      kg =-0.25827
Point =  21  lambda = 0.94589     kg =-0.02873
 * Max # of iters. at corrector step.
 * Reduced Variable Increments in Corrector Step 0.5
Point =  22  lambda = 0.93379     kg =-0.00565
Point =  23  lambda = 0.92165     kg = 0.01749
 * Max # of iters. at corrector step.
 * Reduced Variable Increments in Corrector Step 0.5
Point =  24  lambda = 0.90945     kg = 0.04067
 * corrector solution is too far from predictor value
 * Reached initial lambda.
 * Maximum Loading Parameter lambda_max =  1.5353
Continuation Power Flow completed in 1.3937 s
```

Generator	**1**	**2**	**3**
Rated MVA	247.5	192.0	128.0
kV	16.5	18.0	13.8
P.F	1.0	0.85	0.85
Type	Hydro	Steam	steam
Speed	180 r / min	3600 r / min	3600 r / min
x_d	0.1460	0.8958	1.3125
x_d'	0.0608	0.1198	0.1813
x_q	0.0969	0.8645	1.2578
$x_{q'}$	0.0969	0.1969	0.25
x_l**(leakage)**	0.0336	0.01521	0.0742
τ'_{do}	8.96	6.00	5.89
τ'_{qo}	0	0.535	0.600
Reactance values are in p.u on a 100 MVA base. All time constant in s.			

Table.1. Generator Data

Data need for perform the calculation:

1) A load flow study of pretransient network to determine the mechanical Power Pm, of the generator and to calculate the values of $E_1\angle\delta io$ for all generators. The equivalent impedance of loads are obtained from load bus data.
2) System data follows
   a) The inertia constant H and direct axis transient reactance X_d' for all generators.
   b) Transmission network impedances for the initial network condition and subsequent switching such as fault clearing and breaker reclosing's.
3) The type and location of disturbance, time of switching and maximum time for which a solution is to be obtained.

The disturbance initiating the transient is a three phase Fault occurring near bus7 at the end of line 5-7. The fault cleared in five cycles (0.0835s) by opening line5-7.The generator are represented by the classical models and loads by constant impedance. The damping torque is neglected.

	Bus	**Impedance**		**Admittance**	
		R	**X**	**G**	**B**
Generator					
No.2	2 – 7	0	0.1823	0	-5.4855
No.3	3 - 9	0	0.2399	0	-4.1689
Transmission line	4 – 5	0.0100	0.0850	1.3652	-11.6041
	4 – 6	0.0170	0.0920	1.9422	-10.5107
	5 – 7	0.0320	0.1610	1.1876	-5.9757
	6 – 9	0.0390	0.1700	1.2820	-5.5882
	7 – 8	0.0085	0.0720	1.6171	-13.6980
	8 – 9	0.0119	0.1008	1.1551	-9.7843
Shunt					
Load A	5 – 0	-	-	1.2610	-0.2634
Load B	6 – 0	-	-	0.877	-0.0346
Load C	8 – 0	-	-	0.9690	-0.1601
	4 - 0	-	-	-	0.1670
	………	-	-	-	-
	7 - 0	-	-	-	0.2275
	9 - 0	-	-	-	0.2835

Table2.Prefault Network for system

The reactive power, real power, voltage profile waveform is obtained when the fault occurred in the system shown in Figure.7(a-d) through Matlab run time environment for system shown in Figure.5.

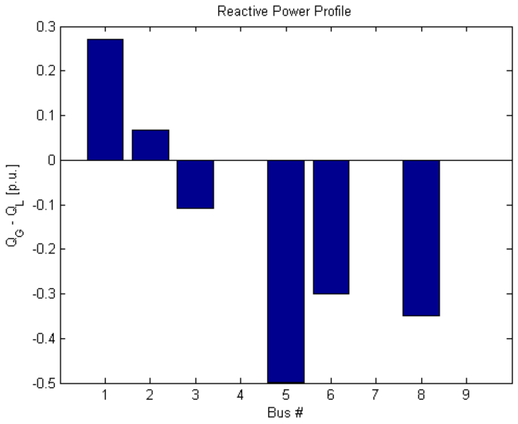


Figure 7(a): Reactive power profile

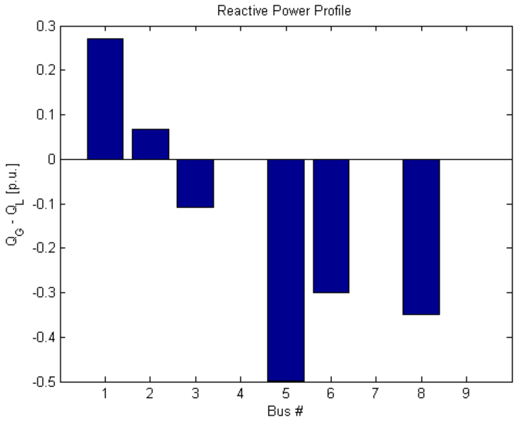


Figure7 (b): Real power profile

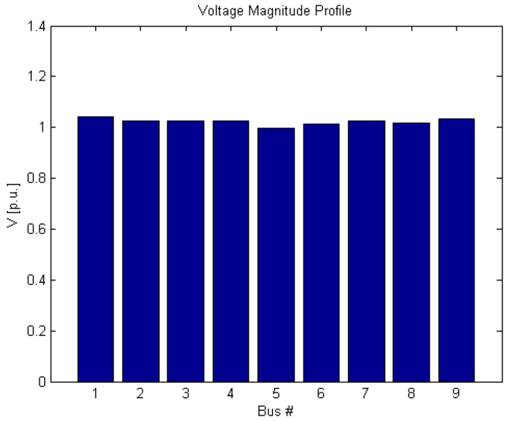


Figure 7(c): Voltage Magnitude Profile

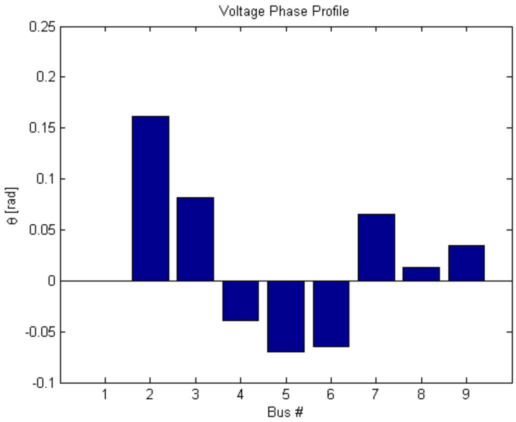


Figure 7(d) :Voltage Phase Profile

The calculated y bus value for the prefault network, faulted network, cleared fault network is given in the Table 3 (a-c)

Table 3(a):Y bus matrix of prefault network

Node	1	2	3	4	5	6	7	8	9
1	j8.4459	-	-	j8.4459	-	-	j5.4855	-	-
2	-	j5.4885	-	-	-	-	-	-	j4.1684
3	-	-	j4.1684	-	-	-	-	-	-
4	j8.4459	-	-	3.3074 – j30.3937	-1.3652 + j11.6041	-1.9422 + j10.5107	-	-	-
5	-	-	-	-1.3652 + j11.6041	3.8138 – j17.8426	-	-1.1876 + j5.9751	-	-
6	-	-	-	-1.9422 + j10.5107	-	4.1019 – j16.1335	-	-	-1.2820 + j5.5882
7	-	j5.4855	-	-	-1.1876 + j5.9751	-	2.8047 – j24.9311	-1.6171 + j13.6980	-
8	-	-	-	-	-	-	-1.6171 +	3.7412 –	-1.1551 +

							j13.6980	j23.6424	j9.7843
9	-	-	j4.1684	-	-	-1.2820 + j5.5882	-	-1.1551 + j9.7843	2.4371 – j19.2574

Table 3(b):Y bus matrix of fault network

Node	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	j8.4459	-	-	j8.4459	-	-	-	-	-
2	-	j5.4855	-	-	-	-	-	-	-
3	-	-	j4.1684	-	-	-	-	-	j4.1684
4	j8.4459	-	-	3.3074 – j30.3937	-1.3652 + j11.6041	-1.9422 + j10.5107	-	-	-
5	-	-	-	-1.3652 + j11.6041	3.8138 – j17.8426	-	-	-	-
6	-	-	-	-1.9422 + j10.5107	-	4.1019 – j16.1335	-	-	-1.2820 + j5.5882
7	-	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	3.7412 – j23.6424	-1.1551 + j9.7843
9	-	-	-j4.1684	-	-	-1.2820 + j5.5882	-	-1.1551 + j9.7843	2.4371 – j19.2574

Table 5. Y bus matrix of network after fault cleared

Node	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	j8.4459	-	-	j8.4459	-	-	-	-	-

2	-	j5.4885	-	-	-	-	j5.4885	-	-
3	-	-	j4.1684	-	-	-	-	-	j4.1684
4	j8.4459	-	-	3.3074 – j30.3937	-1.3652 + j11.6041	-1.9422 + j10.5107	-	-	-
5	-	-	-	-1.3652 + j11.6041	2.6262 – j11.8675	-	-	-	-
6	-	-	-	-1.9422 + j10.5107	-	4.1019 – j16.1335	-	-	-1.2820 + j5.5889
7	-	j5.4885	-	-	-	-	1.6171 – j18.9559	-1.6171 + j13.6980	-
8	-	-	-	-	-	-	-1.6171 + j13.6980	3.7412 – j23.6424	-1.1551 + j9.7843
9	-	-	j4.1684	-	-	-	-	-1.1551 + j9.7843	2.4321 – j19.2574

Table 5. Y bus matrix of network after fault cleared

VI CONCLUSION

The fault detection in the grid connected distributed generating systems is presented in this work. Many distributed systems are operated at different impedance level. By introducing the fault into the network the impedance values are changed. In this method we are using NR method for the impedance calculation. It calculates the impedance at three different conditions. The fault is cleared in nine cycles (0.15s).By comparing the RK method, and FDLF method the NR method is takes less number of iteration to find the impedance value. So the proposed method is suitable for the islanding and fault clearing in a short time duration.

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