Host Utilities

TATA POWER

BSES Rajdhani Power Limited

BSES Yamuna Power Limited

ORGANIZER

ISGF India Smart Grid Forum

India SMART UTILITY Week 2025

Supporting Ministries

MINISTRY OF POWER
GOVERNMENT OF INDIA

MINISTRY OF NEW AND RENEWABLE ENERGY
GOVERNMENT OF INDIA

NITI Aayog

MINISTRY OF POWER
GOVERNMENT OF INDIA
CENTRAL ELECTRICITY AUTHORITY

Session : Disruptive Innovations for Utilities

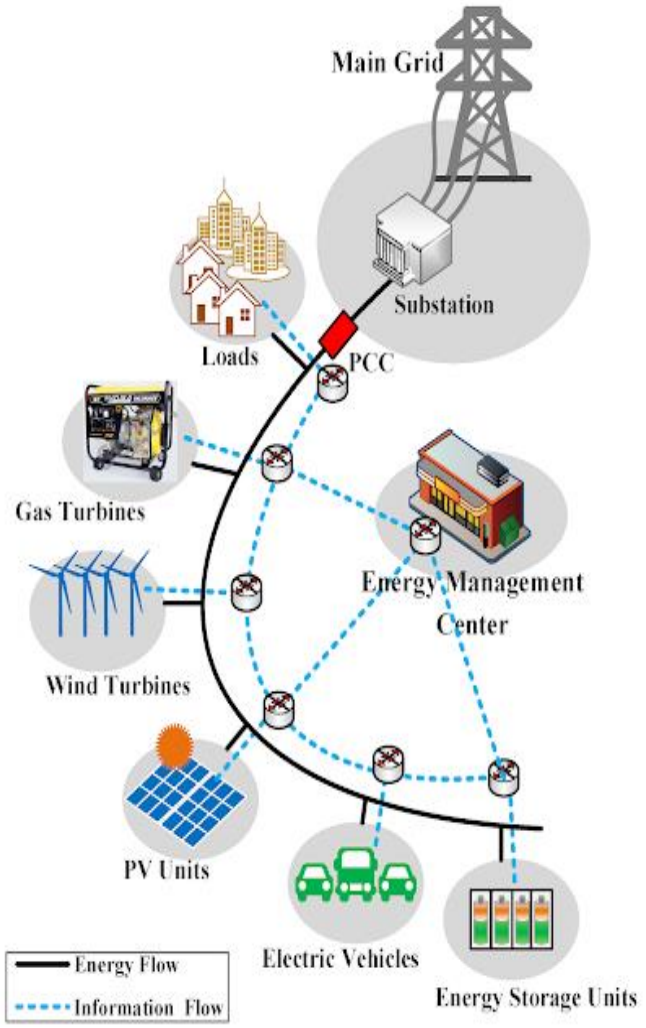
SVM and DWT based Detection and Classification of Microgrid Faults using Single Point Measurement

Presented By:

***Sumangal Bhaumik*, Assistant Professor, AIEM**

INTRODUCTION

- The integration and penetration of renewable energy into the convention grid or microgrid is started growing by adopting various promotional schmes of Govt. of India.
- The ever-growing demand for energy resilience and sustainability environment friendly green energy sources, microgrids have emerged as a transformative solution.
- These inherent distributed nature of these green energy resources (DERs) along with prosumers make the operation of the microgrid or radial distribution system more complicated.
- The conventional protection systems like over current relay, distance protection methods etc. are facing extreme challenge for their reliablabe protection operation.



CONTEXT

Main challenge of microgrid is to detection of fault using conventional methods due to bidirectional power flow and low magnitude of fault current.

Bidirectional Power Flow

Microgrids have bidirectional power flow, making traditional fault detection methods less effective.

Low Fault Current

The low magnitude of fault current current in island mode poses a challenge for conventional protection schemes.

Coordination Challenges

Coordination between protective protective devices is crucial but difficult to achieve in microgrids. microgrids.

Various research works are going on through out the world and numerous methods and techniques are getting evolved so that this type of RESs penetrated power system can run with greater stability and reliability.

RELEVANCE

Different methods to mitigate this problem

- A statistical signal-processing algorithm known as estimation of signal parameters via rotational invariance techniques [1]
- Wavelet-based neural network [2]
- S-transform [3]
- Empirical Mode Decomposition and Hilbert-Transform[4]
- Support Vector Machine-Based Techniques [5]

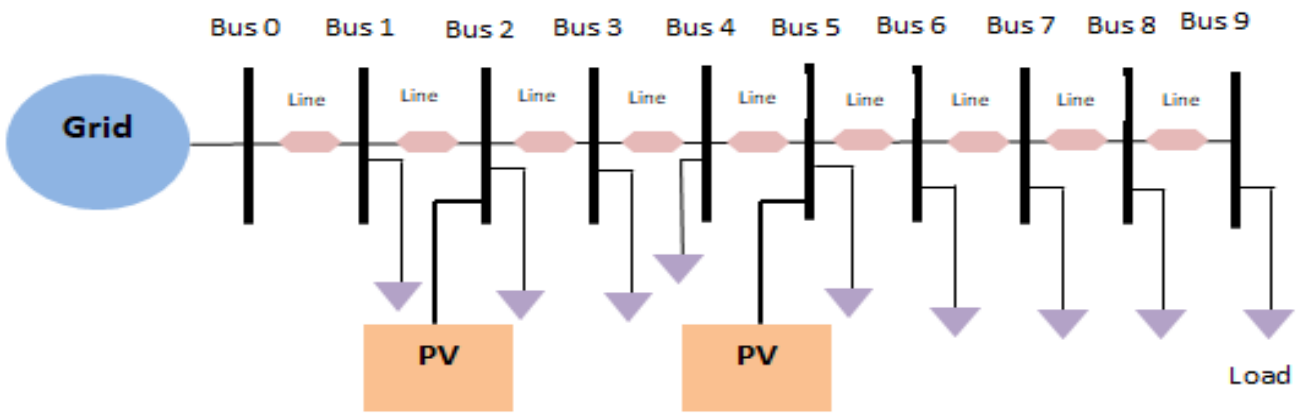
The salient features of the proposed method are as follows:-

(i) single-point current measurement, from PCC only, for detection of fault occurring at any location of the microgrid.

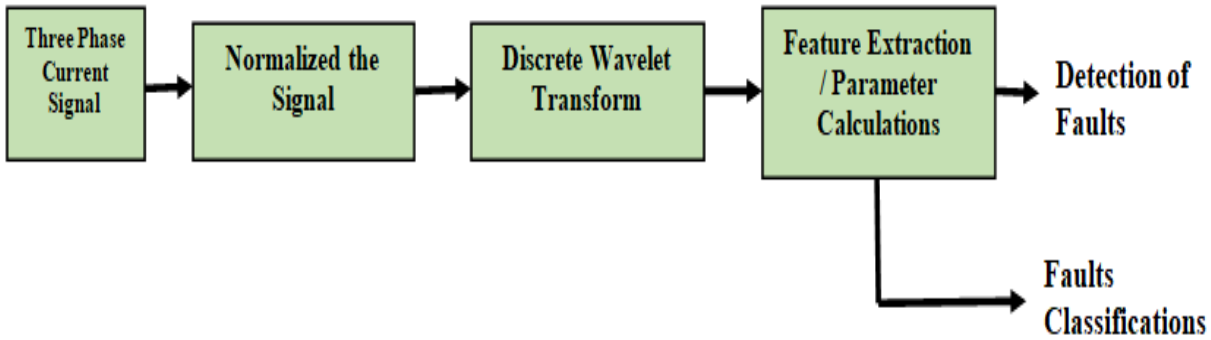
(ii) The Discrete Wavelet Transform (DWT) method is employed to determine the statistical parameters of the measured current to be utilised for fault identification.

(iii) the classification of fault types and the identification of their proper locations are also evaluated accurately by adoption of SVM technique.

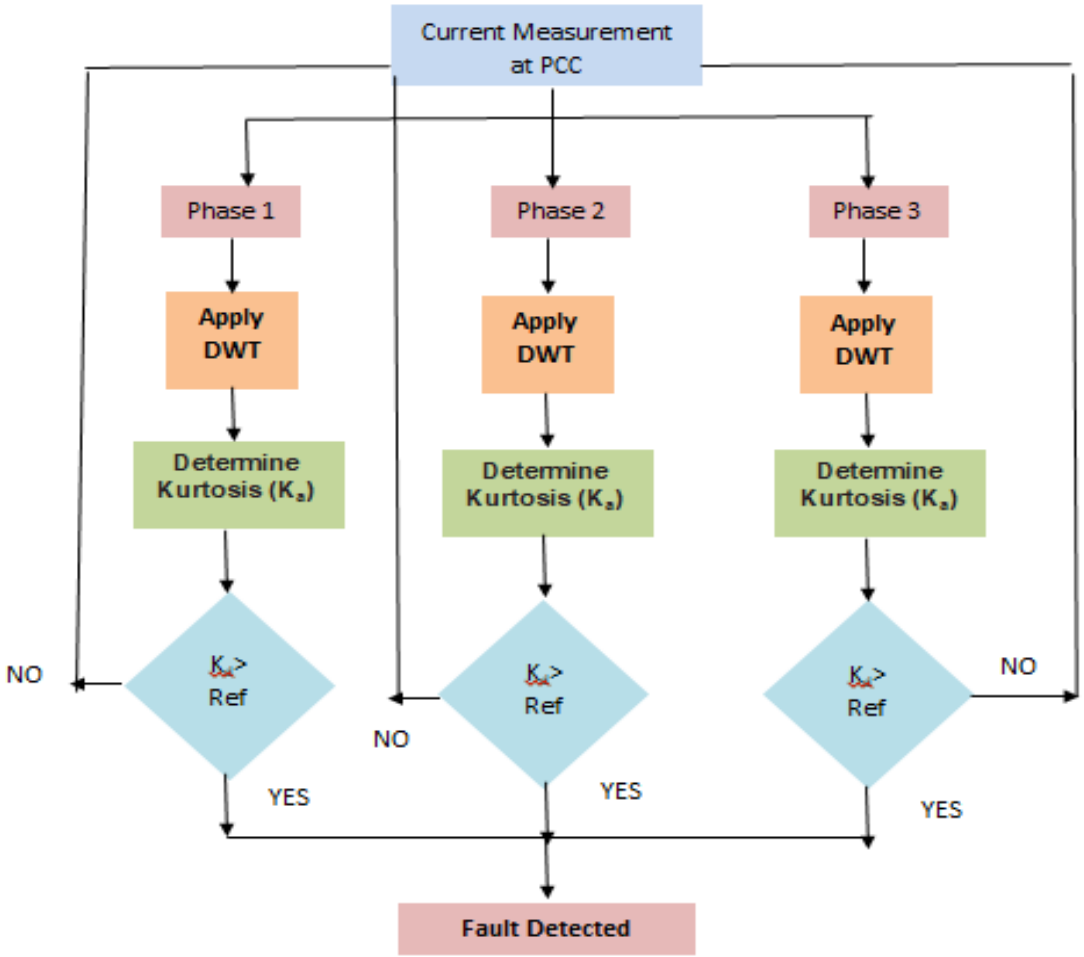
Schematic of the Proposed Methods (1/2)



Proposed Schematic Diagram

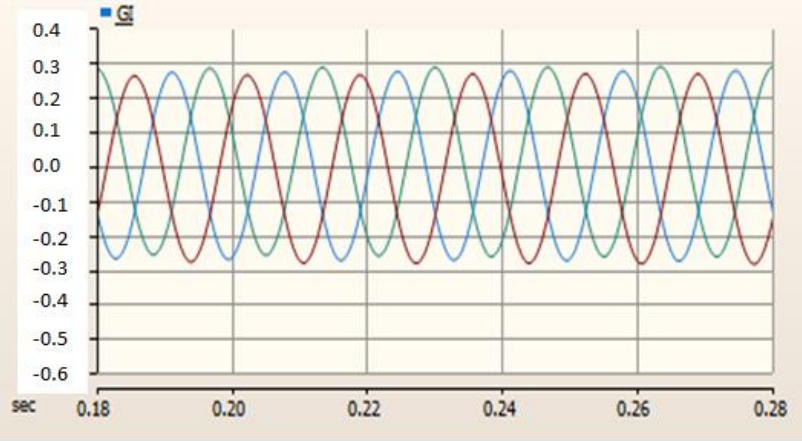


Work Flow Diagram of Fault Assessments

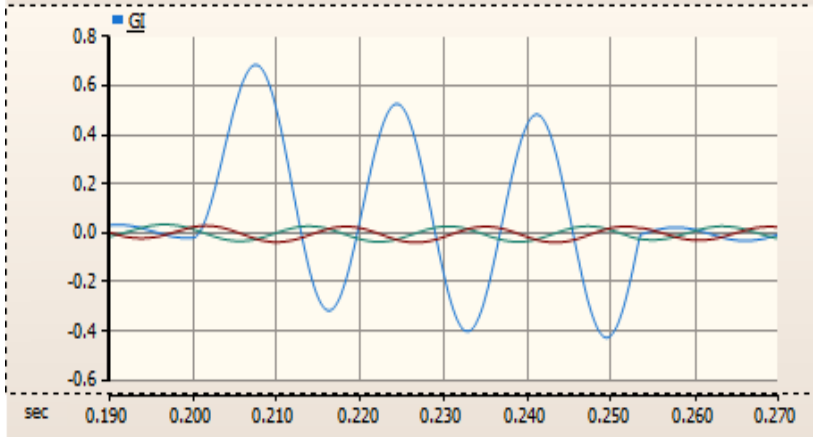


Flow Chart of the Proposed Methods

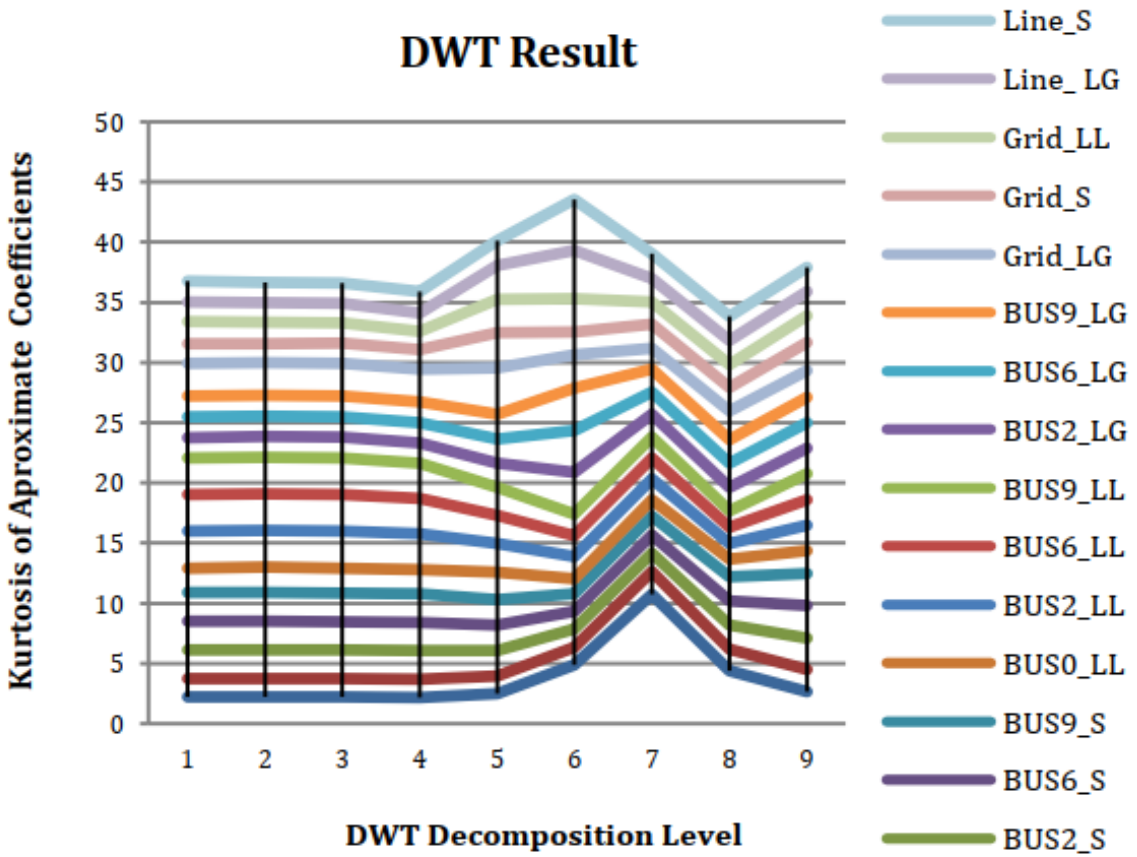
Schematic of the Proposed Methods (2/2)



Normal current at PCC

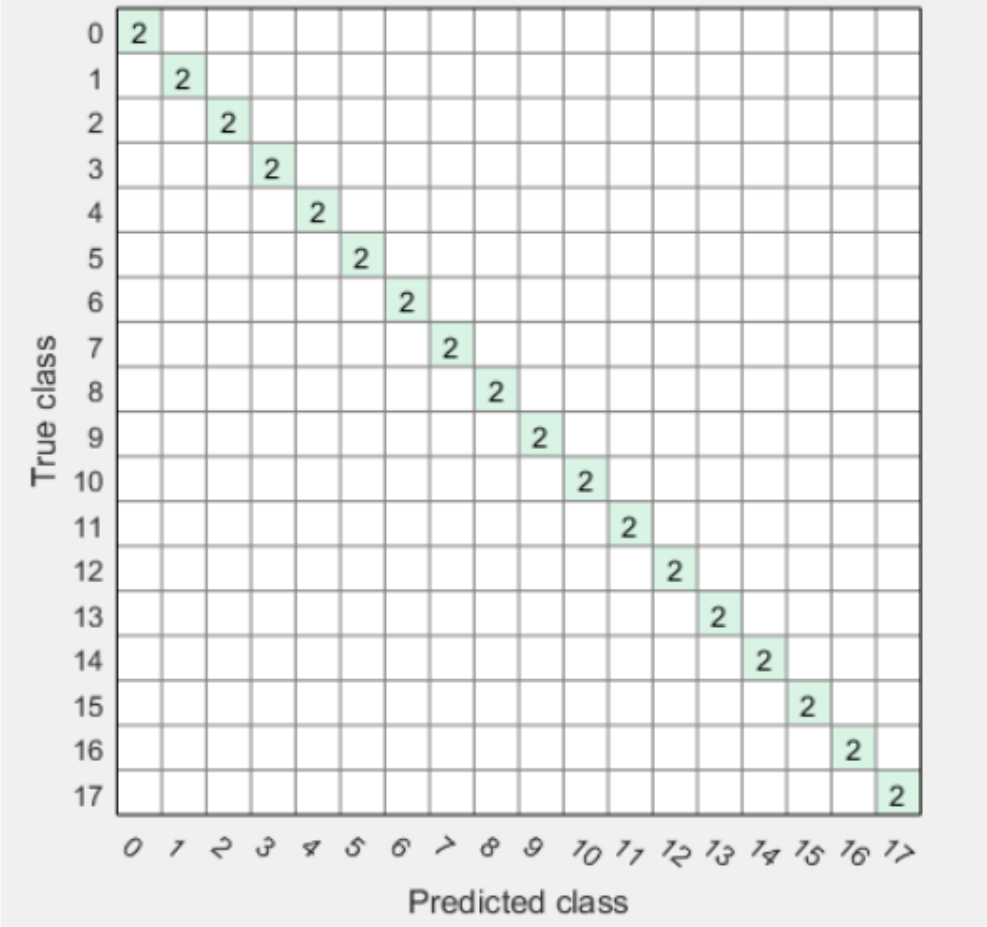


LG fault at BUS 6



Kurtosis Result of capture current using DWT analysis under different Faulty scenario.

CASE STUDY (Result Analysis)



CONFUSION MATRIX OF THE PROPOSED SYSTEM

COMPARATIVE AMONG DIFFERENT CLASSIFICATION METHODS

Sl. No	Methods	Accuracy (%)
1.	SVM (Cubic)	100
2.	KNN (Fine)	83.35
3.	TREE (Fine)	83.33

COMPARATIVE STUDY WITH SOME EXISTING METHODS

Sl. No	References	Execution Time (ms)	Accuracy (%)
1.	[7]	150	95.6
2.	[8]	84	90
3.	[9]	125	94.45
4.	[10]	230	100
5.	[11]	100	99.54
6.	[12][13]	11.8	99.75
7	[14]	50	100
8	Proposed Method	16	100

KEY TAKEAWAYS / RECOMMENDATIONS

- The challenges of detection and classification of fault in renewable energy penetrated microgrid system is addressed in this work. The fault classification based on the current signal, captured from PCC only, of a 9 bus radial microgrid system is approached. It is clearly evident from this Table that the proposed system is also highly efficient and provides 100% accuracy in detection and classification of MG faults under their different running conditions.

REFERENCE

[1] W. K. A. Najy, H. H. Zeineldin, A. H. K. Alaboudy and W. L. Woon, "A Bayesian Passive Islanding Detection Method for Inverter-Based Distributed Generation Using ESPRIT," in IEEE Transactions on Power Delivery.

[2] Zwe-Lee Gaing, "Wavelet-based neural network for power disturbance recognition and classification," in IEEE Transactions on Power Delivery.

[3] A. Langarizadeh, S. Hasheminejad, A new differential algorithm based on S-transform for the micro-grid protection, Electric Power Systems Research.

[4] Bayati, Navid, et al. "EMD/HT-based local fault detection in DC microgrid clusters." IET Smart Grid 5.3 (2022): 177-188.

[5] H. R. Baghaee, D. Mlakić, S. Nikolovski and T. Dragicević, "Support Vector Machine-Based Islanding and Grid Fault Detection in Active Distribution Networks," in IEEE Journal of Emerging and Selected Topics in Power Electronics, vol. 8, no. 3, pp. 2385-2403, Sept. 2020.

Host Utilities

TATA

TATA POWER

BSES

BSES Rajdhani Power Limited

BSES

BSES Yamuna Power Limited

ORGANIZER

ISGF

India Smart Grid Forum

India SMART UTILITY Week 2025

Supporting Ministries

MINISTRY OF POWER
GOVERNMENT OF INDIA

MINISTRY OF NEW AND RENEWABLE ENERGY
GOVERNMENT OF INDIA

NITI Aayog

MINISTRY OF POWER
GOVERNMENT OF INDIA
CENTRAL ELECTRICITY AUTHORITY

THANK YOU