Distinguish Between Wavelet Transform Technique and Wavelet Morphing Technique in The Presence of A Multi-Terminal System

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***Abstract*— this paper deals unique process for recognition of fault on three fatal systems. Here used two techniques for recognition of fault. The wavelet morphing technique detects the fault more effectual, precise, and swiftly compare to the wavelet transform technique (WTT). To distinguish between wavelet transform (WT) technique and wavelet morphing technique (WM) three fatal systems are used. Applied symmetrical and unsymmetrical faults on this three fatal t/m/n system to the obtained summation of the detail co-efficient of the current signal and used these two techniques to recognize the fault swiftly, precisely, and effectually. And compare these two current signals more effective, accurate, and swift results are obtained from the wavelet morphing technique.**

Keywords*— Power system network, Wavelet multi-resolution analysis, Wavelet morphing technique, fault analysis.

I. INTRODUCTION

To obtained uninterrupted power supply to the purchaser. It is very important to detect the fault swiftly to eradicate the fault. More techniques are obtainable to recognize the fault. Here used wavelet transform and wavelet morphing techniques. Morphing plays a significant role in the entertainment industry for fabulous graphic effects. This technique mostly used in image morphing, sound morphing. The system will be protected by using these morphing techniques. The main theme is to find out the fault indices using the WTT and morphing technique. The WTT has a different mother wavelets. Here only used Bior2.2 and the morphing technique used coif1 and bior22 to detect the fault indices. Compare these two technique fault indices to obtain the best result. Different techniques are needed to recognize

The fault because fault will mostly disrupt the power t/m/n system, it causes power flow disruption. So, protection system is needed [1]. Earlier maintenance and refurbishment of supply are helpful for reliable supply and economy enhancement to the patrons. That's why here used the wavelet morphing technique.

The suitable Protection scheme is needed for not only abnormal conditions but also against short circuits which may arise on a power system. Most of the transmission line faults are caused by short circuits that occur due to the wind, natural calamities [2], and many others. A digital distance-protection scheme can control by analysing the measured voltage and current signals using Wavelets [3]. New protection schemes are required to survive with the bi-directional power flow, availability of more numbers of Sources [4]. The proposed algorithm is designed for the protection of two area power system can be done by using wavelet-based multi-resolution analysis[5] with bior2.2 and coif1 mother wavelets and combined Bior2.2 & coif1 i.e., wavelet morphing technique. The protection method is tested under various possible types of faults on two area power system network and it is found that the scheme working properly.

II. ANALYSIS ON WAVELET MORPHING TECHNIQUE

The wavelet theory and its applications to power engineering in ninety eighties are described in [6], while some exact applications are enumerated in [7-8]. Wavelet transforms are mostly used in image compression image Denoising face recognition and motion detection. It is well suited for sharp discontinuities. For analysing transient currents WT is an efficient tool. It not only analyses frequency signal but also provides frequency division under the non-uniform domain, these wavelets are used to decompose the signal in various frequency bands from a mother wavelet by dilation and translation coefficients [9].

The equations of wavelet transforms are given below.

ϕ (t) =$\sqrt{2}\Sigma h(n)\phi$ (2t-n)

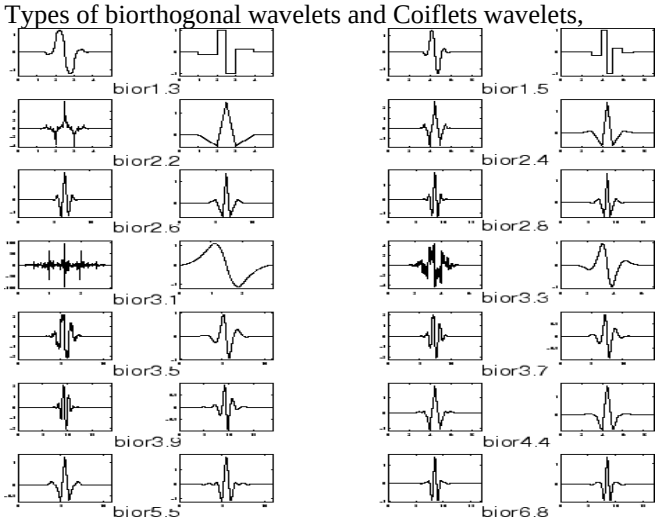
ψ(t) = $\sqrt{2}\sum g(n)\varphi(2t-n)$

Where g(n) = $(-1)^n$ h(1-n)

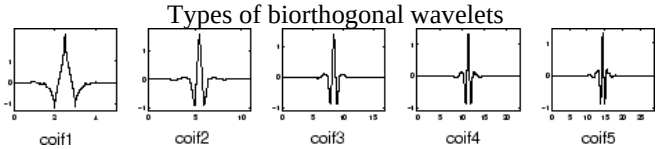
The type of Mother Wavelet is depended on the application to be carried and further apply multi-resolution analysis for detection and discrimination of faults in the transmission Zones [10]. Wavelet morphing is a new technique for smooth transients. Wavelet has different types of mother wavelets. These are Haar, Daubechies, biorthogonal, Coiflets, Symlets, Morlet, Mexican hat, and Meyer. Among these only biorthogonal and Daubechies are taken. Bior mother wavelets are 14 types i.e., bior1.3, bior1.5, bior2.2, and so on. Coiflets mother wavelets are coif1, coif2, coif3, coif4, and coif5. The combination is not possible to any two mother wavelets. Morphing technique is possible between weighted vectors

and these weighted vectors are obtained from each set of detail coefficients and singular decomposition. Here only chosen bior2.2&coif1.

Types of biorthogonal wavelets and Coiflets wavelets,

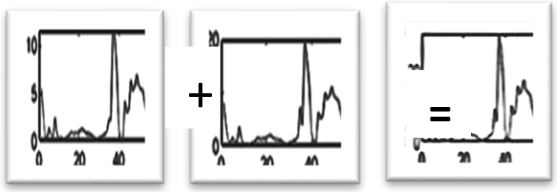


Types of biorthogonal wavelets



Types of coiflets wavelets

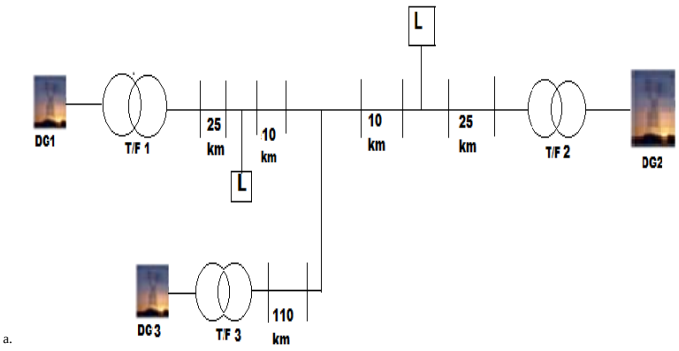
Coiflets are 5 types and coif A. A represents numbers of vanishing moments. Biorthogonal wavelet doesn't conserve energy at a stage of the application. It also has many vanishing moments.



BIOR2.2 COIF1 BIOR2.2&COIF1

The above figures are bior2.2 and coir1 and a combination of both bior2.2 and coif1. Compare these waves, output results are changed and obtained higher frequency distortion and accuracy also increased.

Details coefficients of current signals are calculated using Bior2.2&coif1 i.e., wavelet morphing technique and calibrated by the summation of the detailed coefficients are used to detect, classify on two area power system network.



a.

Fig. 1. Single line diagram of a multi-terminal system

terminal 1	DG1	132KV, 900MVA Y-g,
terminal 2	DG2	4.16KV, 5MVA
terminal 3	DG3	4.16KV, 10.75MVA
T/m/n line (Distributed)		R=0.173 OHM/Km R_0 = 0.432OHM/Km L= 1.15e-3 H/Km L_0=4.78e-3 H/Km C=11.33e-9 F/km, C_0 = 5.01e-9 F/km
Transformers ratings		T/F 1= 132KV/34.2KV T/F 2 = 34.2KV/4.16KV T/F 3 = 34.2/4.16KV
Mother Wavelet		Bior 2.2, Coif1
Sampling frequency		192Khz
Samples/cycles		32

FIG.2. SYSTEM PARAMETERS AND DETAILS.

From figure .1 is proposed system used this system will be divided into five zones. Zone-1 and zone-4 are 25km, zone-2 and zone-3 are 10km and finally zone-5 are 110km t/m/n line length. Three-phase fault applied at every zone. Using the MATLAB program, wavelet transform and wavelet morphing techniques programs are run. Frequency 60 Hz each cycle gives 32 sample frequencies. The sampling frequency is 192 kHz. At each zone and every zone, all symmetrical and unsymmetrical faults are applied. And all faults are determined using these two techniques. WT technique only used bior2.2 mother wavelet and the WM technique used both bior2.2 and coif1. Distinguish these two summations of DC's results. When distinguishing these results swiftly, the exact and efficient output is obtained from the WM technique. So WM technique is the best method for t/m/n system protection to remove the disturbance on the power t/m/n system.

IV. RESULTS AND DISCUSSION

DC's of fault indices are obtained from wavelet-based MRA and three-phase current signals are obtained. Below results fault applied on zone-1, length 25km three-phase fault between these lengths, i.e., between 12.5km and all symmetrical and unsymmetrical faults are applied result ae given below.

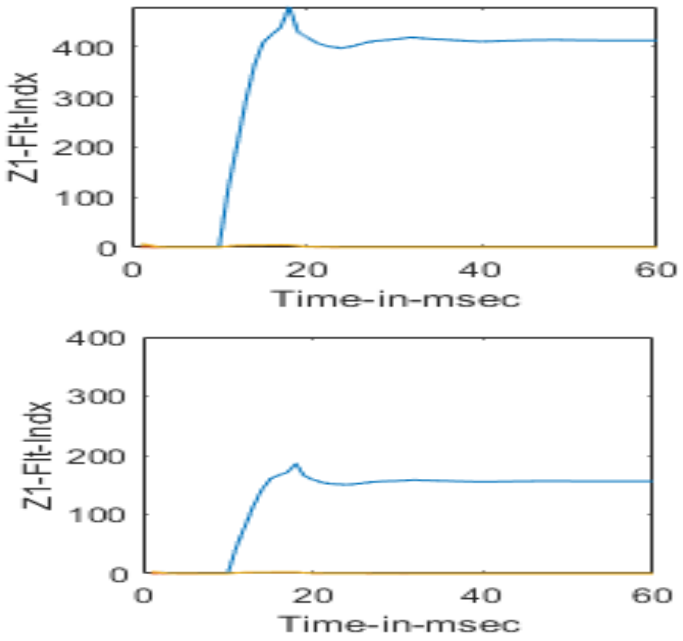


Fig.3 L-G fault on zone-1 using W & W.O wavelet morphing technique

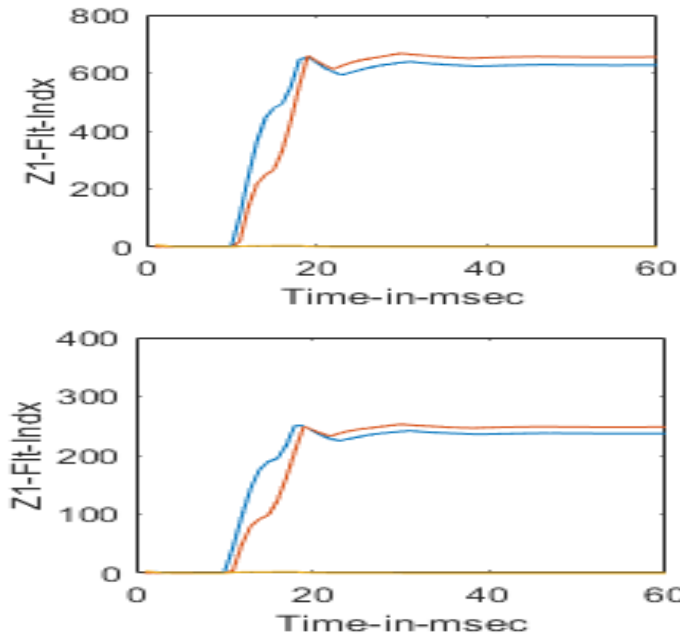
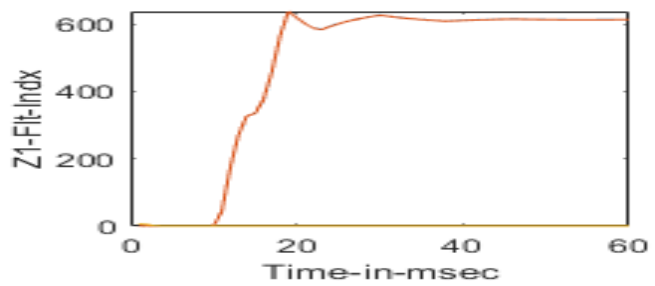


Fig.4 LL-G fault on zone-1 using W & W.O wavelet morphing technique



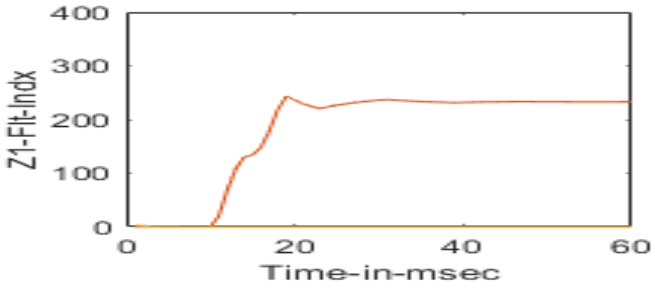


Fig.5 L-L fault on zone-1 using W & W.O wavelet morphing technique.

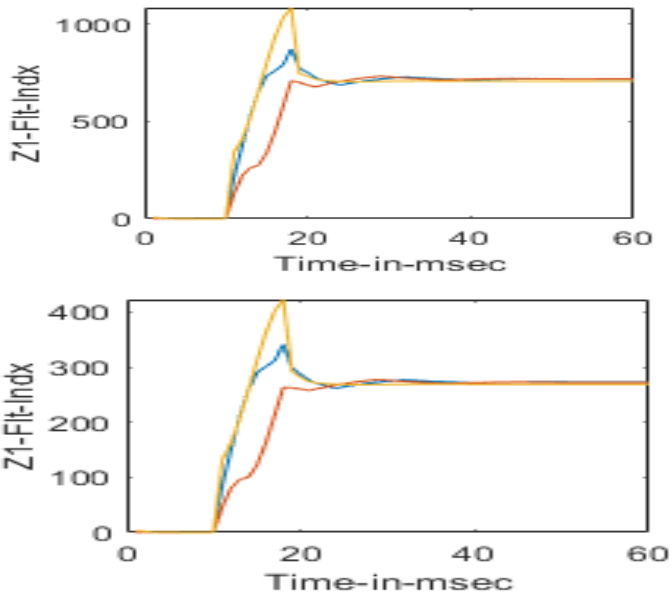
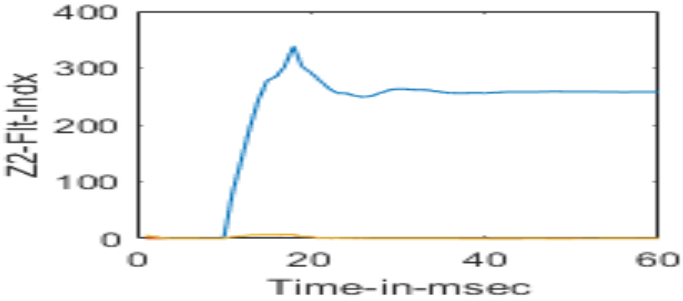


Fig.6 LLL fault on zone-1 using W & W.O wavelet morphing technique

Fig. 3 to fig.6 shows zone-1 faults, in fig.3 applied L-G fault observed these results more accuracy and quick output are obtained from with wavelet morphing technique. Without the morphing technique located the accuracy 200amps and with the morphing technique located accuracy at 400amps. And fault detected time set at 20msec but before 20msec fault is detected. In fig. 4 shows LL-G fault more accuracy at morphing technique at 700amps and fig.5 L-L fault accuracy more detected at 650 and finally LLL fault accuracy more detected at 1000 above. From these results, the wavelet morphing technique detected the fault very swiftly, accurately, and exactly.

Zone-2 faults are given below and this zone length is 10km and fault applied between 10km i.e., 10km divided into 5km and 5km and fault applied between these two lengths. all kinds of faults are applied.



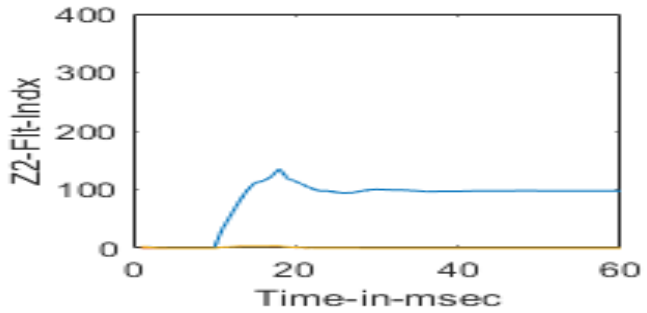


Fig.7 L-G fault on zone-2 using W & W.O wavelet morphing technique

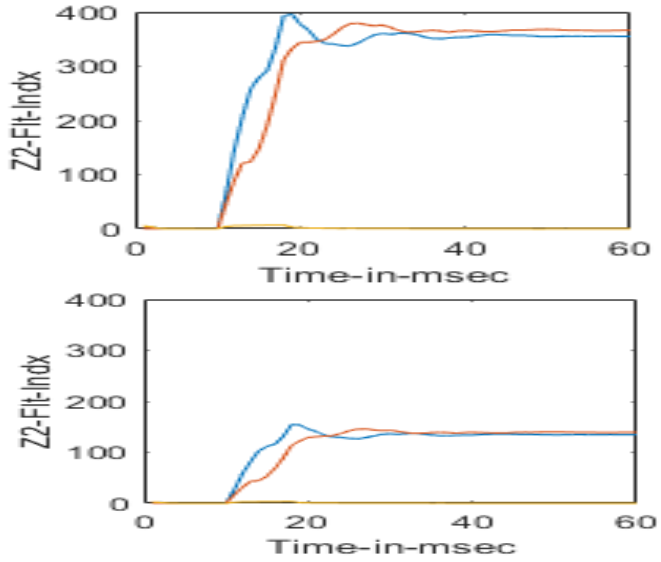


Fig.8 LL-G fault on zone-2 using W & W.O wavelet morphing technique

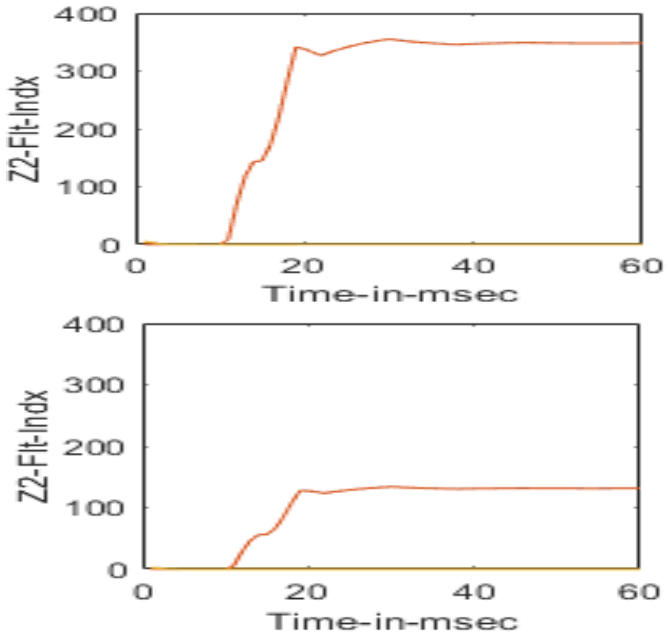
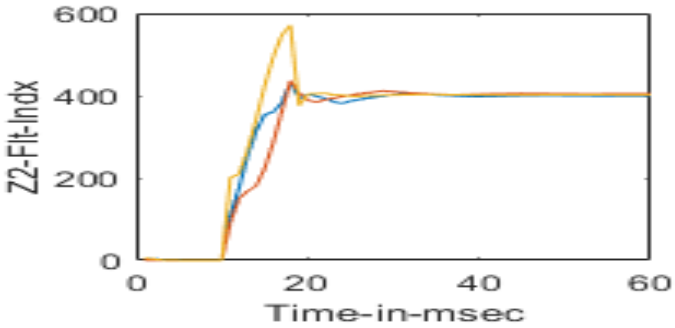


Fig.9 L-L fault on zone-2 using W & W.O wavelet morphing technique



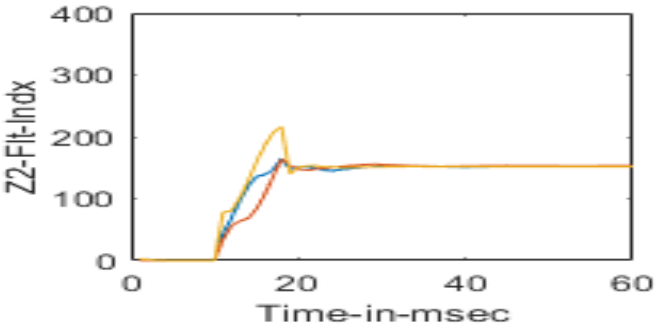


Fig.10 LLL fault on zone-2 using W & W.O wavelet morphing technique

From the above figures, fig.7 to fig.10 gives the zone-2 faults on three fatal t/m/n system. Here also observed the same results as zone-1. Compare W &W.O morphing technique more accuracy and the swift result are obtained from the morphing technique in all kinds of faults. But less fault is detected compare to zone-1 because of less t/m/n length.

The below figures give zone-3 faults, the zone-3 length is 10km, three faults applied between 5km and 5km.all types of faults are applied.

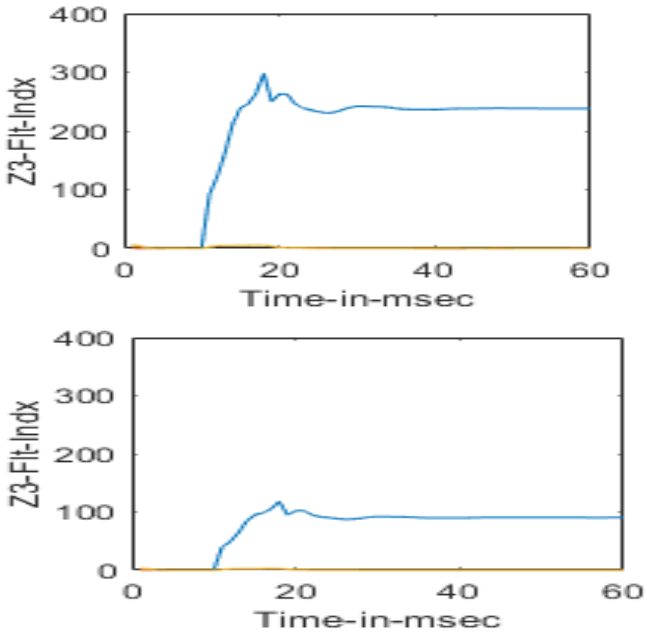


Fig.11 L-G fault on zone-3 using W & W.O wavelet morphing technique

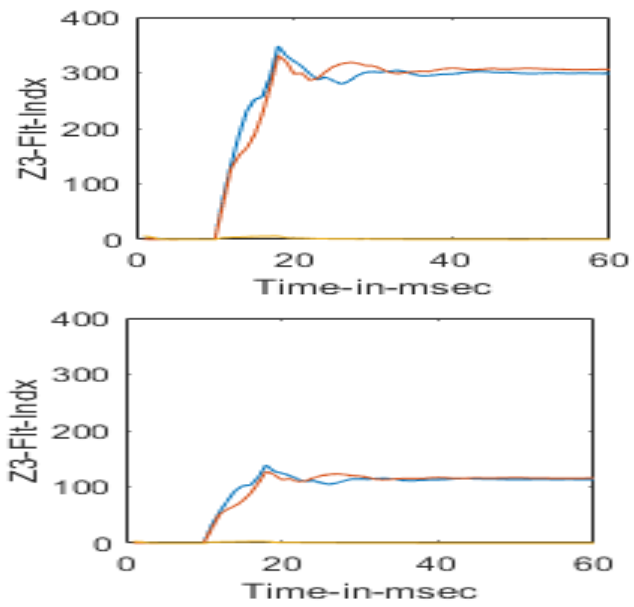


Fig.12 LL-G fault on zone-3 using W & W.O wavelet morphing technique

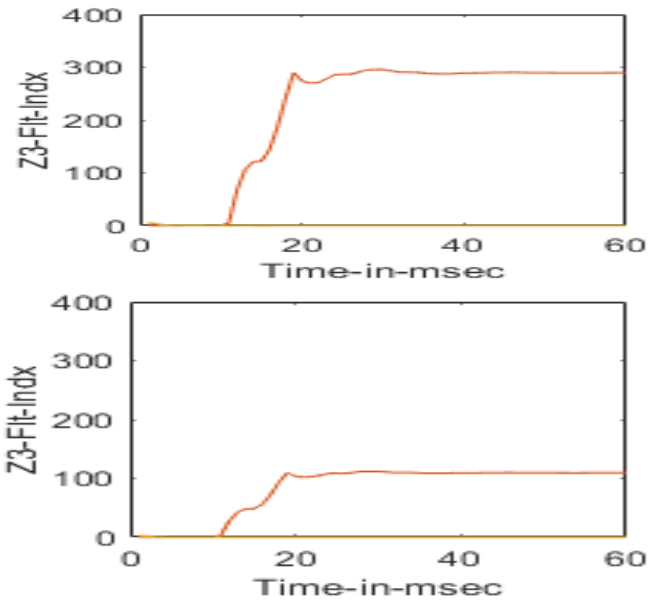
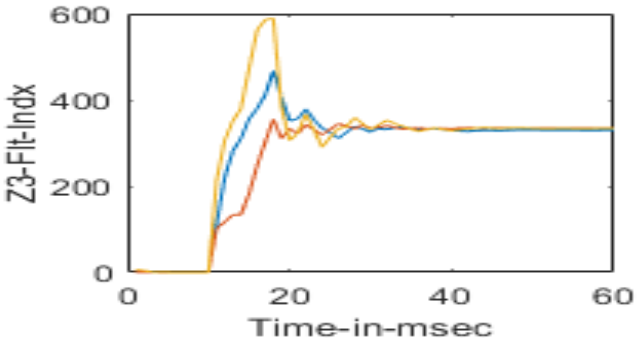


Fig.13 L-L fault on zone-3 using W & W.O wavelet morphing technique



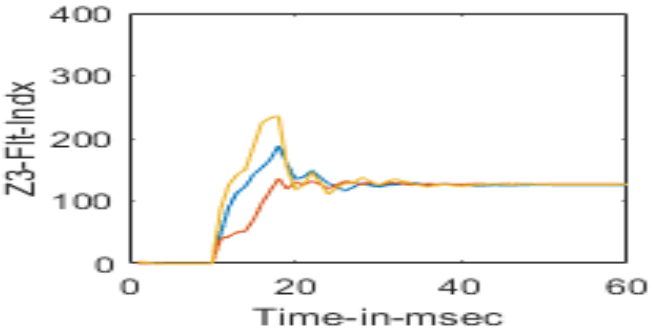


Fig.14 LLL fault on zone-3 using W & W.O wavelet morphing technique

From the above figures, fig.11 to fig.14 current signal fault indices are zone-3 all types of fault results here also more accuracy and swift output is obtained from the morphing technique.

Zone-4 fault sare given below it has 25km length, and fault applied 25km t/m/n line and all types are fault results are given below.

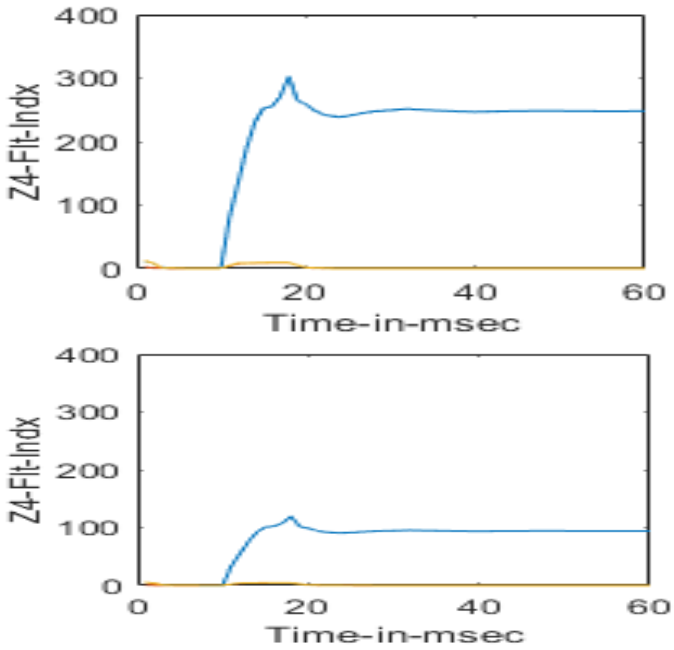
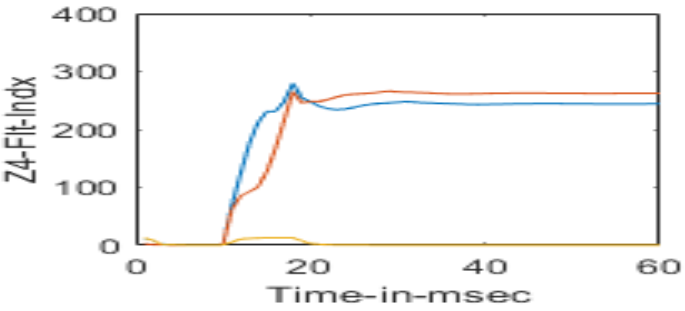


Fig.15 L-G fault on zone-4 using W & W.O wavelet morphing technique



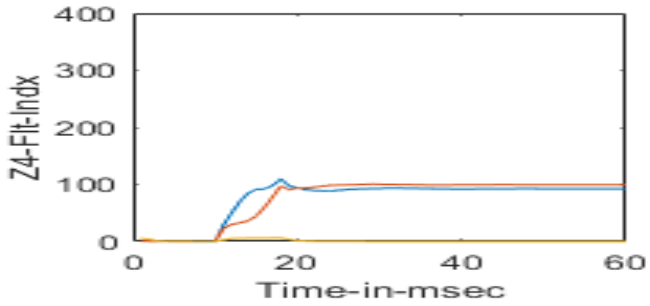
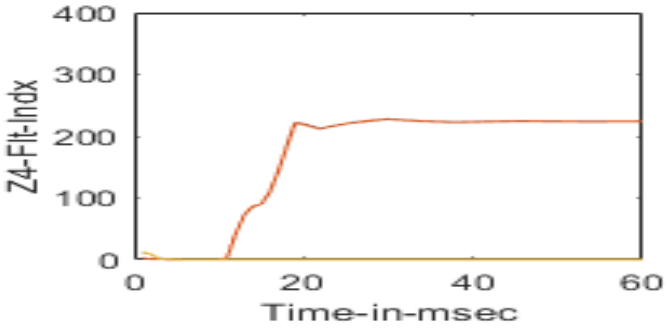


Fig.16 LL-G fault on zone-4 using W & W.O wavelet morphing technique



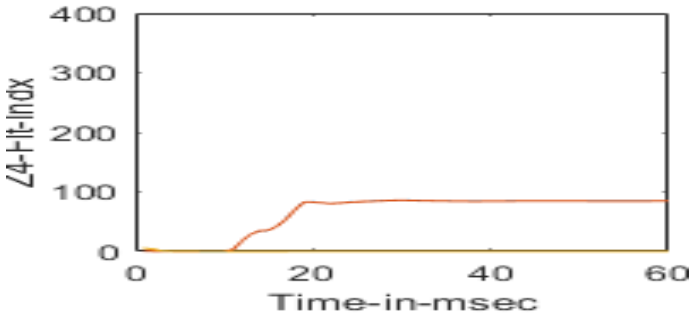
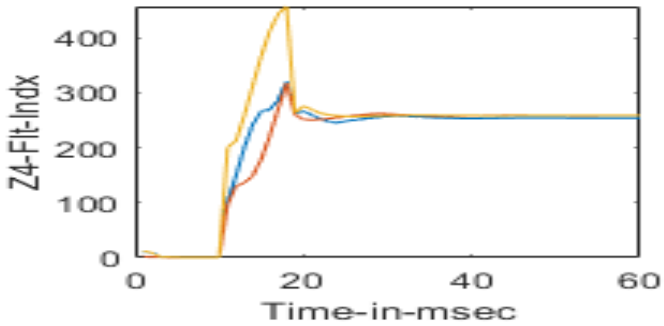


Fig.17 L-L fault on zone-4 using W & W.O wavelet morphing technique



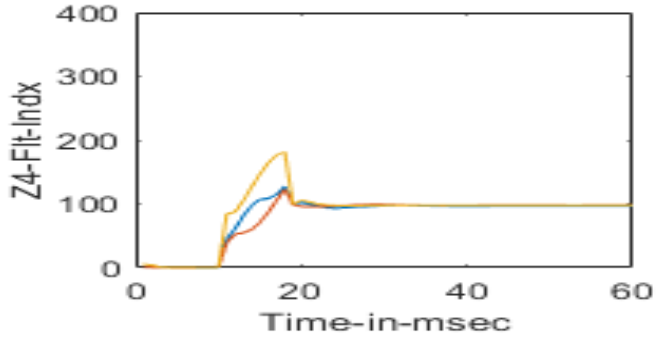
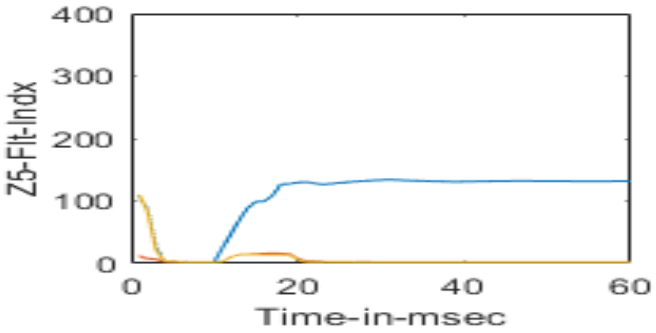


Fig.18 LLL fault on zone-4 using W & W.O wavelet morphing technique.Above figures, fig.15 to fig.18 gives the zone-4 fault here also more accuracy and the swift result is obtained from the morphing technique.

Zone-5 has a 110km t/m/n line and three-phase fault applied at zone-5 and all types of faults are applied.



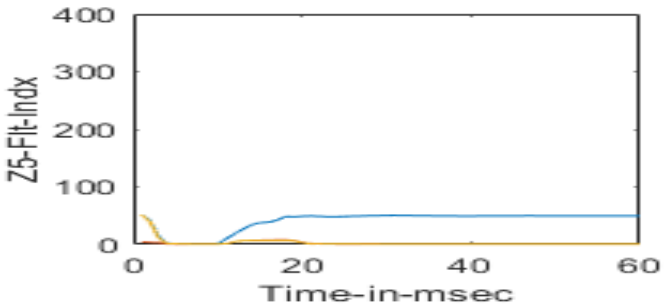
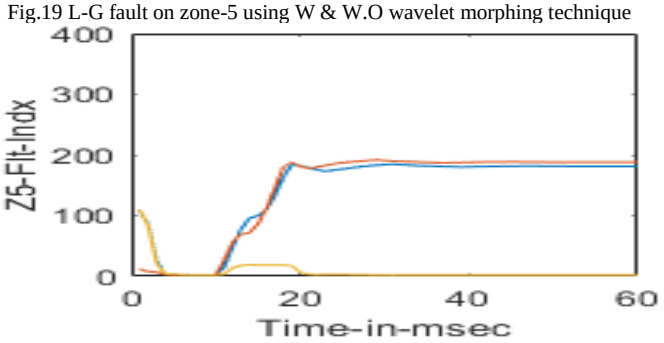


Fig.19 L-G fault on zone-5 using W & W.O wavelet morphing technique



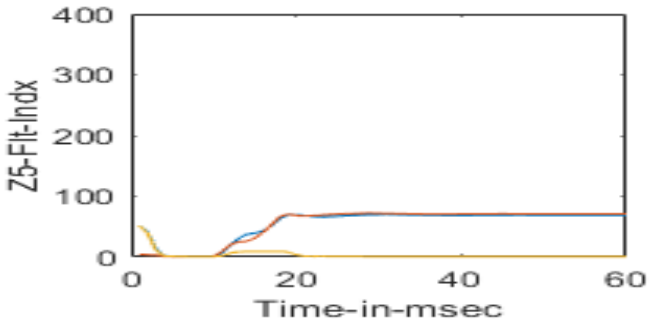
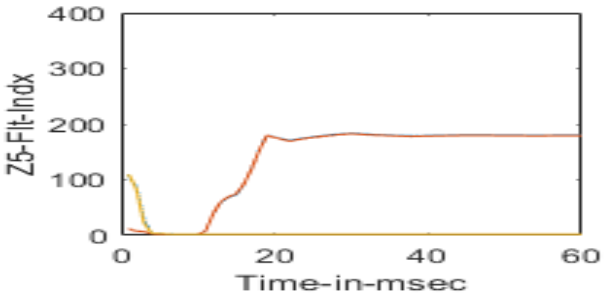


Fig.20 LL-G fault on zone-5 using W & W.O wavelet morphing technique



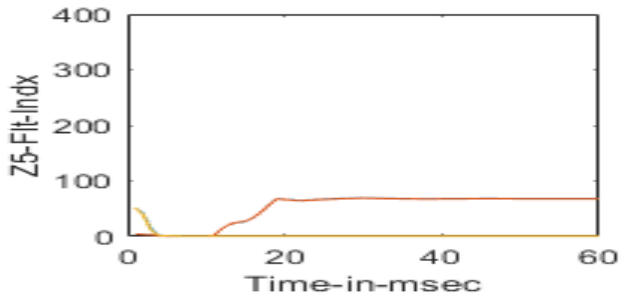


Fig.21 L-L fault on zone-5 using W & W.O wavelet morphing technique

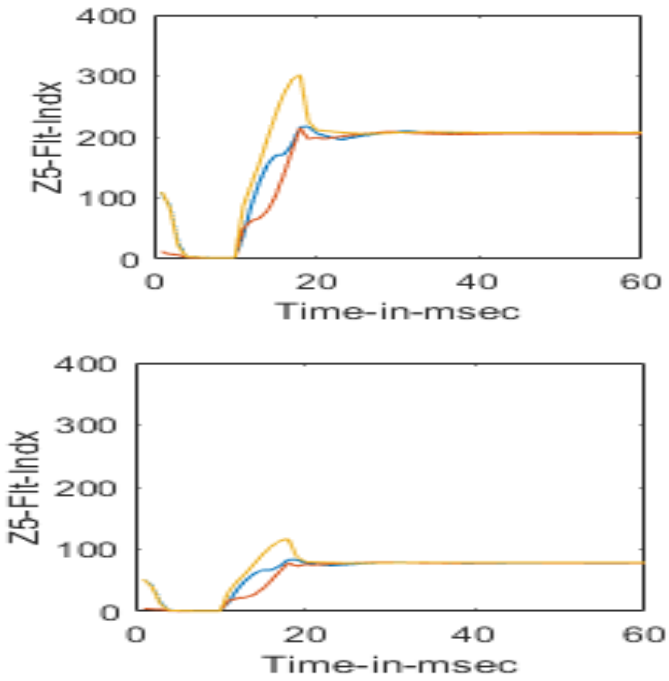


Fig.22 LLL fault on zone-5 using W & W.O wavelet morphing technique.

From the above zone-5 results in more accuracy and swift detection are only possible by using a wavelet morphing technique compare to the WTT.Finally, it is applicable to detect the fault swiftly, accurately, and effectively.

CONCLUSION

The proposed multi-terminal t/m/n system proved that the wavelet morphing technique gives a very swift, precise, and exact result. Using the MATLAB program wavelet transform and wavelet morphing techniques are used to detect the detail co-efficient of current signals. Each current signal are decomposed and examined each part of the signal. Fault indices are obtained from detail co-efficient. All types of faults are applied on three fatal t/m/n system and compared wavelet transform (mother wavelet used bior2.2) fault indices and wavelet morphing technique (mother wavelets used bior2.2&coif1) fault indices. More accuracy and exact location and the swift result are obtained from the wavelet morphing technique.

So, finally, the wavelet morphing technique is useful for the t/m/n protection system to clear the fault swiftly.

REFERENCES

[1] Johns, A.T. and Salman S.K., Digital Protection for Power Systems, Peter Peregrinus Publications, 1995.

[2] Osman AH, Malik O P, "Transmission line distance protection based on wavelet transform", *IEEE Transactions on Power Delivery*, 2004, 19(2), pp.515–523.

[3] Peyman Jafarian, Majid Sanaye-Pasand, " High-Frequency TransientsBased Protection of Multiterminal Transmission Lines Using the SVM Technique," IEEE Transactions On Power Delivery0885-8977/$31.00 © 2012 IEEE

[4]] C. S. Burrus and R. A. Gopinath, Introduction to Wavelets and Wavelet Transforms a Primer. Englewood Cliffs, NJ: Prentice-Hall, 1988.

[5] Gaouda, A.M., Safama, M.M.A., et al., 1999. Power quality detection and classification using wavelet-multi resolution signal decomposition. IEEE Trans. Power Deliv. 14 (4), 1469–1476

[6] Liang Feng, Jeyasura B. Transmission line distance protection using wavelet transform algorithm. IEEE Trans Power Deliv 2004; 19(2):545–53.

[7] Joe-Air Jiang, Ping-Lin Fan, Ching-Shan Chen, Chin_Wen Liu, "A New Protection Scheme for Fault Detection, Direction Discrimination, Classification, and Location in Transmission Lines", IEEE Trans. on Power Delivery, Vol.18. No.1, January 2003, pp. 34-42.

[8] A. Wiesniewski, "Accurate fault impedance locating algorithm," Proc. Inst. Elect. Eng., pt. C, vol. 130, no. 6, pp. 311–314, 1983.

[9] F. Boccardi and C. Drioli, "Sound morphing with Gaussian mixture models," in Proc. 2001 Int. Conf. Digital Audio Effects, Limerick, Ireland, Dec. 2001, pp. 44–48.

[10] Ravi Kumar Goli, Abdul Gafoor Shaik , S.S Tulasi Ram, "A transient current based double line transmission system protection using fuzzy wavelet approach in the presence of UPFC," Electrical Power and Energy Systems 70 (2015) 91–98.