wjert, 2020, Vol. 6, Issue 6, 199-205. Original Article ISSN 2454-695X

World Journal of Engineering Research and Technology

WJERT

www.wjert.org

Impact Factor Value: 5.924

OPTIMIZATION OF ARTIFICIAL INTELLIGENCE TO MINIMIZATION OF TOTAL HARMONIC DISTORTIONS IN INDUSTRIES

***[1]Sangeeta and [2]Er. Harjeet Singh**

[1]M.Tech Student, Department of Computer Sc. & Engg. St. Soldier Institute of Engg. & Technology, Jalandhar (Punjab).

[2]Assistant Professor, Department of Computer Sc. & Engg. St. Soldier Institute of Engg. & Technology, Jalandhar (Punjab).

Article Received on 25/09/2020 **Article Revised on 15/10/2020** **Article Accepted on 05/11/2020**

***Corresponding Author**
Sangeeta
M.Tech Student, Department of Computer Sc. & Engg. St. Soldier Institute of Engg. & Technology, Jalandhar (Punjab).

ABSTRACT

Artificial Intelligence is based on a biological inspired process in which a stronger individual is the final solution among all the individuals in the competition i.e. survival of the fittest. This individual represents the set of solution and is composed of different parameters. These parameters are called genes of a chromosomes and is represented by binary strings. The best possible (the fittest) solution at the end approaches the optimum point through several iterations of the algorithm. The bio-inspired intelligent algorithm is one of the best methods for optimization. The aim of using AI here is to optimize the switching angles to reduce the low order odd harmonics. This can be done by genetic algorithm to minimize the objective function.

KEYWORDS: THD, AI, MATLAB.

I. INTRODUCTION

Minimizing total harmonic distortion (THD) with less system complexity and computation time is a stringent constraint for many power systems. The multilevel inverter can have low THD when switching angles are selected at the fundamental frequency. For low-order harmonic minimization, selective harmonic elimination (SHE) is the most adopted and proficient technique but it involves the non-linear transcendental

equations which are very difficult to solve analytically and numerically. This research proposes a Artificial Intelligence based optimization technique to minimize the THD of cascaded H-bridge multilevel inverter. The AI is the finest approach for solving such complex equations by obtaining optimized switching angles. The switching angles are calculated by the genetic algorithm by solving the nonlinear transcendental equations. This paper has modeled and simulated a five-level inverter in MATLAB Simulink. The THD comparison is carried out between step modulation method and optimization method. The results reveal that THD has been reduced. The optimization method along with LC filter significantly improves the power quality providing a complete sinusoidal signal for varying load.

II. Fuzzy Logic

The term fuzzy refers to things which are not clear or are vague. In the real world many times we encounter a situation when we can't determine whether the state is true or false, their fuzzy logic provides a very valuable flexibility for reasoning. In this way, we can consider the inaccuracies and uncertainties of any situation.

In boolean system truth value, 1.0 represents absolute truth value and 0.0 represents absolute false value. But in the fuzzy system, there is no logic for absolute truth and absolute false value. But in fuzzy logic, there is intermediate value too present which is partially true and partially false.

III. Architecture of Fuzzy Logic

Its Architecture contains four parts

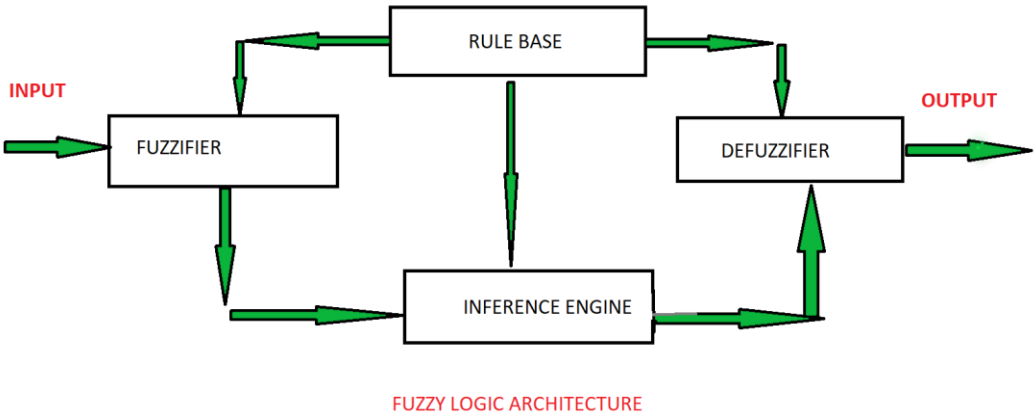

Fig. 1: Architecture of Fuzzy Logic.

IV. Artificial intelligence (AI)

Artificial Intelligence is intelligence demonstrated by machines, unlike the natural intelligence displayed by humans and animals. Leading AI textbooks define the field as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals. Colloquially, the term "artificial intelligence" is often used to describe machines (or computers) that mimic "cognitive" functions that humans associate with the human mind, such as "learning" and "problem solving".

V. Proposed Algorithm

The proposed calculation based methodology is proposed to tackle the nonlinear supernatural conditions of particular consonant end of fell H-connect staggered inverter. The absolute symphonious contortion (THD) correlation is completed between step balance technique and improvement strategy. The improvement strategy finds the exchanging points in such a manner to limit the THD and low request odd sounds. Fell H-connect design is more useful than diode clipped and flying capacitor staggered inverter in light of less number of segments and intricacy. Greatness of major part isn't controllable and is steady all through the cycle while the size of symphonious segment relies upon request of music conversely. The recreation is done in MATLAB/Simulink and the ideal arrangement is given therefore because of its quick iterative technique. The enhancement technique is tried with LC channel which brings about a total sinusoidal sign with the huge improvement of THD. The outcome is checked by differing the heap. It likewise shows the significance of channel to the joining of lattice, mechanical, and keen framework applications.

VI. Objectives

1. To minimize the THD of generated output voltage waveform by determining the switching angles.
2. To propose an Artificial Intelligence (AI) based fuzzy logic optimization technique to minimize the THD.
3. To implement and analysis of input voltage and TDH using Unbalanced supply with & without Fuzzy Logic controller.

VII. RESULTS AND DISCUSSION

The THD comparison is carried out between optimization method with fuzzy logic controller and without fuzzy logic controller on unbalanced power supply.

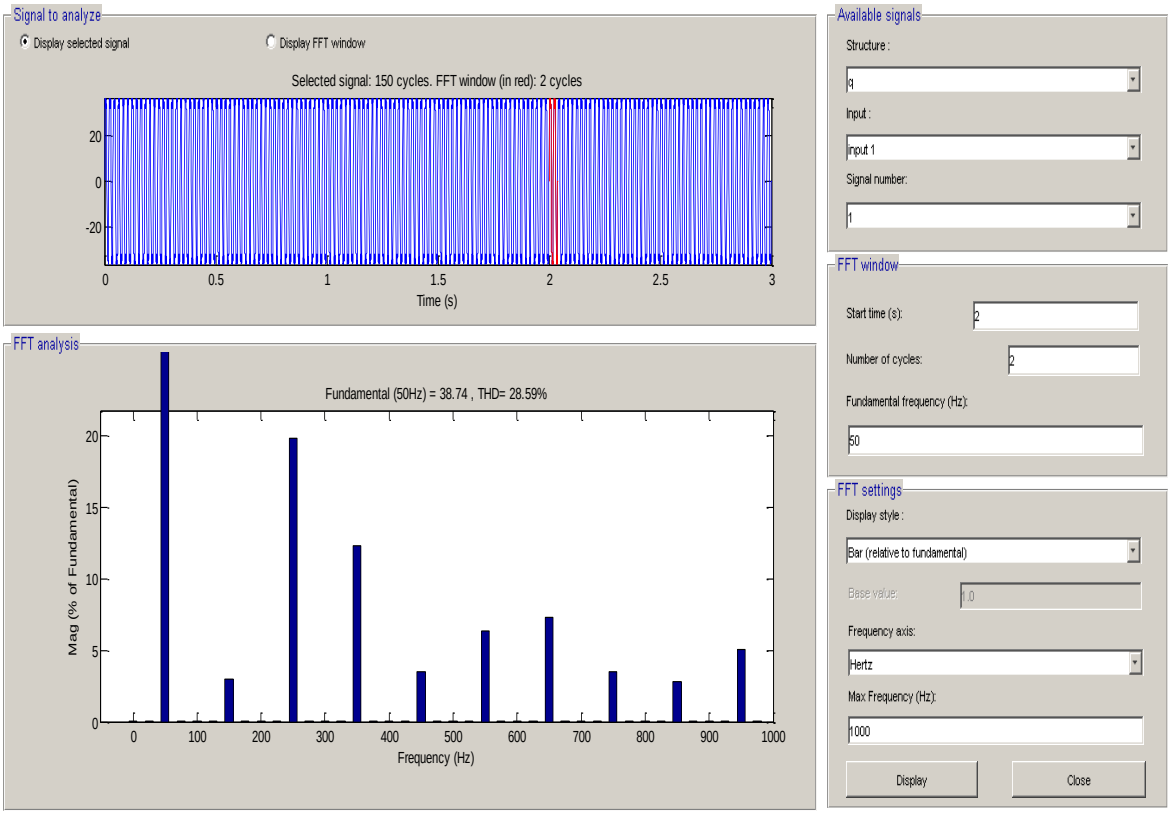

Fig. 2: Shows the TDH value 28.59% on unbalanced power supply with load 110 Ω with fuzzy controller.

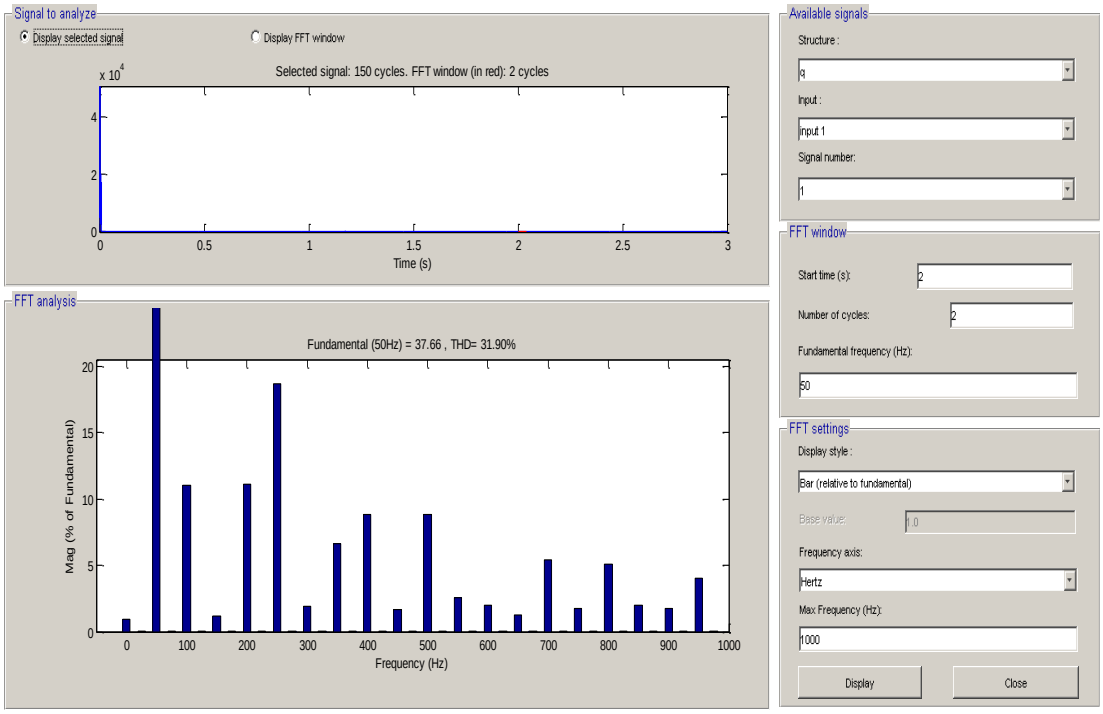

Fig. 3: Shows the TDH value 31.90% on unbalanced power supply with load 110 Ω without fuzzy controller.

Table 1: Voltage THD versus the load, obtained by optimization approach.

Load	THD of Unbalanced Power Supply with Fuzzy Logic Controller	THD of Unbalanced Power Supply without Fuzzy Logic Controller	Reduction in THD
110	28.59	31.90	3.31
120	26.35	32.29	5.94
130	26.28	33.74	7.46
140	24.66	34.73	10.07
150	24.19	36.15	11.96
160	22.72	36.42	13.70
170	21.40	37.13	15.73
180	20.97	37.98	17.01
190	20.57	38.52	17.95
200	19.40	38.15	18.75

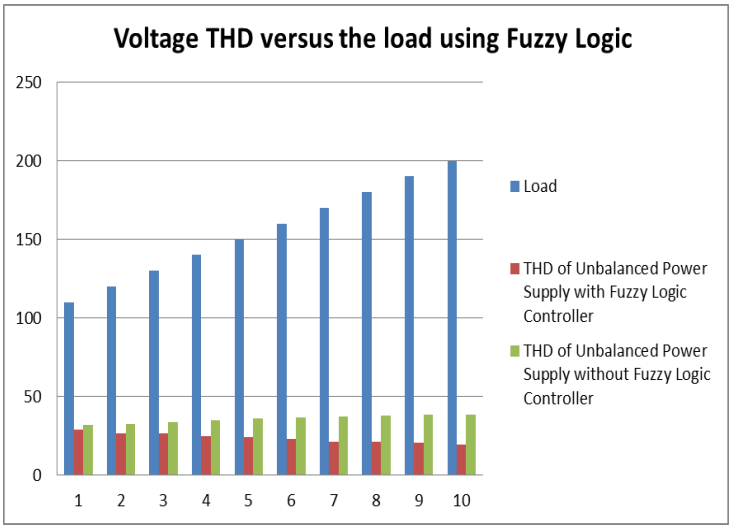

Fig. 4: Voltage THD versus the load, obtained by optimization approach.

Table 2: Values shows the minimization in TDH during unbalanced power supply using fuzzy logic controller.

Load	Reducing THD%
200	18.75
190	17.95
180	17.01
170	15.73
160	13.70
150	11.96
140	10.07
130	7.46
120	5.94
110	3.31

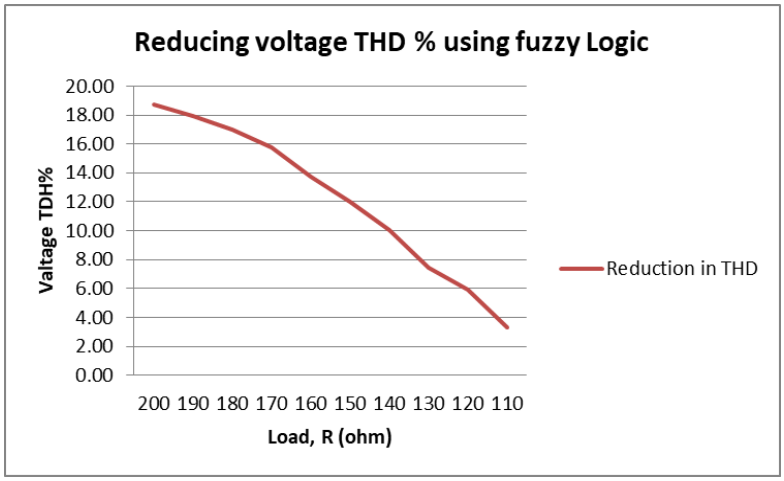

Fig. 5: Shows the minimization in TDH during unbalanced power supply using fuzzy logic controller.

The results reveal that THD has been reduced from 18.75 to 3.31% while third and fifth harmonics have been reduced from 17.01%, 15.73% to 13.70% and 11.96%, respectively.

VII. CONCLUSION

Fundamental component is not controllable and is constant throughout the cycle while the magnitude of harmonic component depends on order of harmonics inversely. The simulation is done in MATLAB/Simulink and the optimum solution is provided subsequently due to its fast the figure 5.5 to figure 5.20 shows TDH value of unbalanced power supply with different load with and without fuzzy controller. The results reveal that THD has been reduced from 18.75% to 3.31%, while third and fifth harmonics have been reduced from 17.01%, 15.73% to 13.70% and 11.96% respectively. Comparison of results with active harmonic elimination technique shows that the THD and the switching frequency of output voltage decreased dramatically. The result is verified by varying the load. It also shows the importance of filter to the integration of grid, industrial, and smart grid applications.

This work can be extended to multilevel inverters with reduced number of switches for further enhancement of output waveform.

REFERENCES

1. Mehrdad Tarafdar Hagh, Hassan Taghizadeh, Kaveh Razi “Harmonic Minimization in Multilevel Inverters Using Modified Species-Based Particle Swarm Optimization”, IEEE Transactions On Power Electronics, OCTOBER 2009; 24(10).

2. Parul Gaur, Preeti Singh, "Optimization Techniques For Harmonics Minimization In Cascaded Hybrid Multilevel Converters: A Review", IJRET: International Journal of Research in Engineering and Technology, Mar-2015; 04(03).
3. Muhammad Salman, Inzamam Ul Haq, Tanvir Ahmad, Haider Ali, Affaq Qamar, Abdul Basit, Murad Khan and Javed Iqbal, "Minimization of total harmonic distortions of cascaded H-bridge multilevel inverter by utilizing bio inspired AI algorithm", Journal on Wireless Communications and Networking, Springer 2020.
4. Ms. Madhuri Mali, Dr. B.G.Patil, "THD Minimization in Multilevel Inverter Using Optimization Approach", International Journal of Engineering Research & Technology (IJERT), June-2018; 7(06).
5. Uing-Shian Chiou, Nguyen Thanh Nam, And Vo Tuyen, "Adaptive Fuzzy Control Method for a Single Tilt Tricopter", IEEE, 2019.
6. Amarjyoti Gogoi, Shubham Sharma, "Some Aspects of Fuzzy Logic Controller for Designing MPPT Based SPV System", International Conference on Recent Innovations in Electrical, Electronics & Communication Engineering - (ICRIEECE), IEEE, 2020.
7. Feng Xiang, Zhixin Sun, "An Adaptive DE Algorithm Based Fuzzy Logic Anti-swing Controller for Overhead Crane Systems", Springer, 2020.