A STUDY ON VOLTAGE REGULATION USING FUZZY ANALYSIS IN ADVANCE

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ABSTRACT: Electric power is the most important factor in our day to day life. The Necessity of electric power is increasing in both domestic and industry. In this study we are going to control the electricity consumption in industries using fuzzy control system. Fuzzy logic control system is a Mathematical system that examines the analog input values in terms of logical variables which take on continuous values between 0 and 1. The algorithm which is designed in this study helps to regulate the unbalance watts under different conditions of the utility supply. Many recent works have reported the application of fuzzy logic to solve on aid the solution of some power system problem. At last, theoretically the power consumption was minimized.

1 INTRODUCTION:

Lotfi Zadeh is the person who first gave the idea of fuzzy logic. He studied in the University of California at Berkeley in the year 1960's. The term fuzzy means that the things which are not clear. We have face the situation that we couldn't get conclude whether the statement is true or false. In such kind of situation fuzzy logic gives a valuable flexibility for reasoning. Fuzzy logic is an extension of boolean system. There is no logic for absolute truth and absolute false value in the fuzzy system. But in fuzzy logic, there exist intermediate values like partially true and partially false.

I. DEFINITIONS:

This section, speaks about the basic definitions of current and fuzzy sets.

II. CURRENT:

The flow of electrical charge is called Current. It usually carries electrons or electron - deficient atoms. The Standard unit of current is ampere.

III. VOLTAGE:

The pressure from an electrical circuit's power source that pushes charged electrons through a conducting loop, enabling them to do work such as illuminating a light is called voltage. The measure of voltage is Volts (V).

IV. VOLTAGE REGULATION:

The measure of change in the voltage magnitude between the sending and receiving and of a component is called Voltage regulation.

V. MEMBERSHIP FUNCTION:

A graph that defines how each point in the input space is mapped to membership value between o and 1. Input space is often referred as universe of discourse of universal set (u), which as contains all the possible elements of concern in each particular application.

VI. CRISP SET:

A set defined using a characteristic function that assigns a value of either 0 or 1 to each element of the universe, thereby discriminating between members and non-members of the crisp set under consideration.

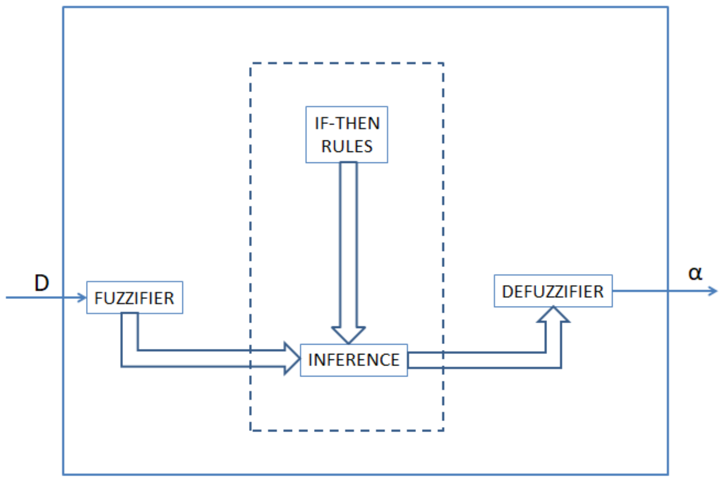
VII. FUZZY SET:

A fuzzy set 'A' is called triangular fuzzy number with peak (0 centre) a, left width α>0 , and right width β>0 if its membership function has the following form:

$$A(t) = \begin{cases} 1 - (a - t)/\alpha & \text{if } a - \alpha \le t \le a \\ 1 - (t - a)/\beta & \text{if } a \le t \le a + \beta \end{cases}$$

The architecture of fuzzy logic contains four parts. They are

- Rule Base
- Fuzzification
- Inference Process
- Defuzzification



VIII. FUZZIFICATION:

The process of converting a crisp input value to a fuzzy value is called Fuzzification. It is performed by the use of the information in the knowledge base. The Linguistic variables of fuzzy are used to represent qualities spanning a particular spectrum. Simply, we can say fuzzification is the process of converting a numerical variable into a linguistic label.

IX. *INFERENCE PROCESS:*

The process of combining the membership functions with the control rules to derive the fuzzy output is called Inference process.

X. DEFUZZIFICATION:

The process of producing a quantifiable result in crisp logic, given fuzzy sets and Corresponding membership degrees is called defuzzification. In another form, we can say that the mapping from fuzzy set to a crisp set is the defuzzification. In fuzzy control system the defuzzgification process in very much needed.

Defuzzification is the most preferable process for its speed. In some situation, defuzzification process is needed to convert the resulting fuzzy set description of an action into a specific value for a control variable. The found crisp value by the found is the method of defuzzification is very easy for calculation. It also reflects in the output. The membership value depends upon the shape of the waveform.

FORMULA:

Peak value which represent in the graph is denoted as the power saver value. It is represented as P_x and P_y. To find the output value, we have to use the formula which is represented below,

Output value = (Peak value of *x* X Membership value of *x*)

+ (Peak value of *y* X Membership value of *y*)

x is the upper triangle region and *y* is the lower triangle region. μ_x and μ_y are the corresponding membership values for *x* and y.

STEPS IN VOLTAGE REGULATION

Step-1: Finding the $\frac{n}{2}$ value from the given Output value n.

Step 2: Getting membership value for the corresponding $\frac{n}{2}$ value.

Step 3: Choose the corresponding peak value to the membership value.

Step 4: Use the below formula to find the output value.

$P_x \ \mu_x + P_y \ \mu_y$ = Output value.

Step 5: In case the output value which is found is not approximate to the' n' value, again proceed the algorithm from step 2 for the proceeding illustrations.

VOLTAGE REGULATION IN INDUSTRIES:

VIVACE SYSTEM is the student's project centre located in Ambattur. Many engineering projects have done by this centre. In this centre they are using machinery tools like arc welding machine, metal cutting machine, grinding machine, and also a computer, 2 Air conditioners, 8 fans and 6 tube lights are available. The consumption of electricity is 10 kw / day . We are going to regulate the voltage by the fuzzy logic controller.

ILLUSTRATION FOR WATTS REGULATION:

Peak value is said to be the power saver value in the graph which is represented below. There are six linguistic variables defined in the graph.They are Negative, Zero, Nearly Zero, Positively Small, Positively Large, Positively Maximum. We have separate them with the help of the colours. The crisp value lies approximately in the Positively Large and Positively Maximum according to the input value.

ILLUSTRATION 1

Step 1 : n= 10 , n = $\frac{10}{2}$ = 5 KW

The Crisp input value in the graph is 5KW

Step 2 : The linguistic regions for 5KW are found to be Nearly zero and Positively Small as shown in the fig 1. And their membership values are 0.385 and 0.824.

Step 3 : The peak values for the corresponding membership values 0.385 and 0.824 are 4 and 6.

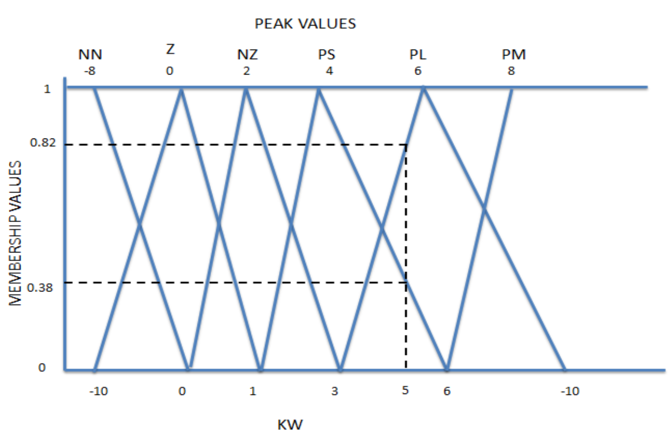


Figure1

Step 4 : $P_x\ \mu_x + P_y\ \mu_y$ = Output value.

$P_x\ \mu_x$ = 0.385 x 4 = 1.540

$P_y\ \mu_y$ = 0.824 x 6 = 4.944

Output value = 6.484

Step 5 : The Crisp output value is 6.484 . And it is not equal to the required output value. So we have to proceed the next illustration from step 2 with the next input value 7KW.

ILLUSTRATION 2

Step 2 : The linguistic regions for 7KW are found to be Positively Large and Positively Maximum as shown in the fig 2. And their membership values are 0.467 and 0.592.

Step 3 : The peak values for the corresponding membership values 0.467 and 0.592 are 8 and 6.

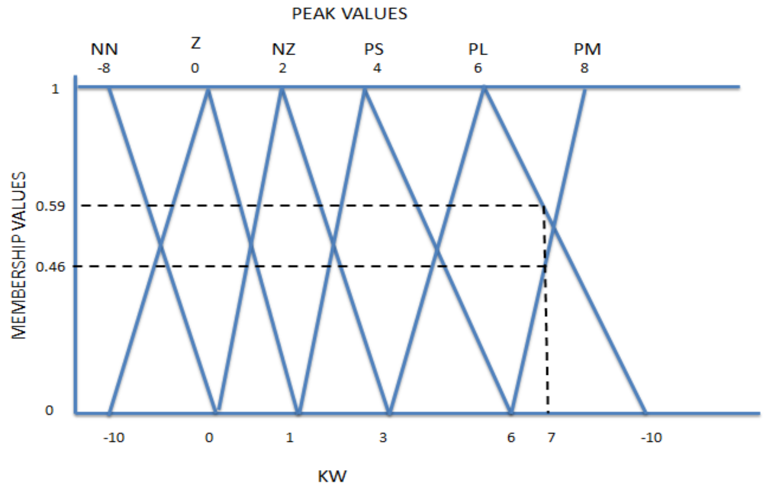


Figure 2

Step 4 : $P_x\ \mu_x + P_y\ \mu_y$ = Output value.

$P_x\ \mu_x$ = 0.467 x 8 = 3.736

$P_y\ \mu_y$ = 0.592 x 6 = 3.552

Output value = 7.288

Step 5 : The Crisp output value is 7.288 . And it is not equal to the required output value. So we have to proceed the next illustration from step 2 with the next input value 8KW.

ILLUSTRATION 3

Step 2 : The linguistic regions for 8KW are found to be Positively Large and Positively Maximum as shown in the fig 3. And their membership values are 0.412 and 0.886.

Step 3 : The peak values for the corresponding membership values 0.412 and 0.886 are 6 and 8.

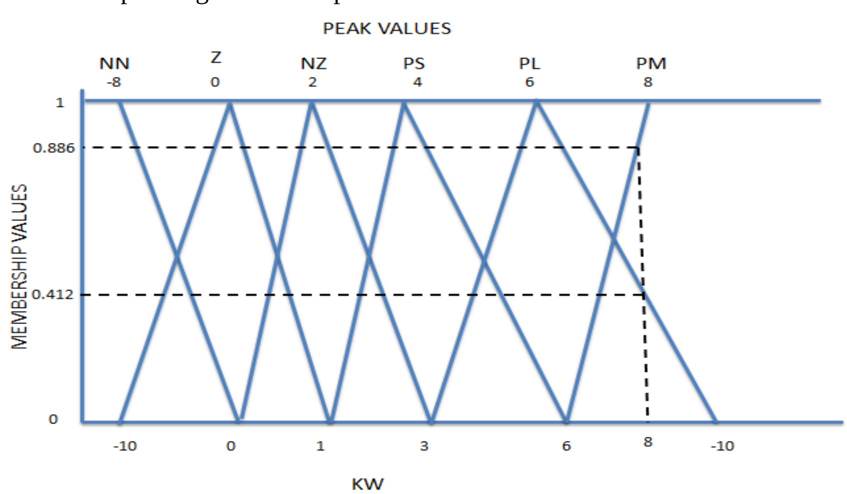


Figure 3

Step 4 : $P_x \mu_x + P_y \mu_y$ = Output value.

$P_x \mu_x = 0.412 \times 6 = 2.472$

$P_y \mu_y = 0.886 \times 8 = 7.088$

Output value = 9.560 ≅ 10

Step 5 : The Crisp output value is 9.560 which is approximately equal to 10 . This is the required crisp output value.

So we can reduce 2KW

FUZZY SETS	INPUT SETS	OUTPUT SETS	OUTPUT COMPONENTS
Negative (NN)	0	-8	0
Zero (Z)	0	0	0
Nearly Zero (NZ)	0	2	0
Positive Small (PS)	0	4	0
Positive Large (PL)	0.412	6	2.472
Positive Maximum (PM)	0.886	8	7.088

CONCLUSION :

We have discussed about fuzzy logic controller and meaning of electricity. We have proved the electric consumption theoretically in this paper. Finally we have reduced the electricity bill in VIVACE SYSTEM. We can reduce 2KW per day and totally 60KW per month.

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