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A Superposition Theorem of Linear Network Using Triangular Fuzzy System

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Abstract

In this paper, new approaches to find the approximate solution of triangular fuzzy superposition theorem for calculations method of electrical current is determine the function to optimize the current source. We introduce the triangular fuzzy system of superposition theorem for fuzzy linear circuit and also find the approximate solution of real life situation of fuzzy linear system and numerical illustrations are given.

Keywords: *Superposition theorem, triangular fuzzy System, linear circuit, etc.*

1. Introduction:

First defined the fuzzy concept 1965, Zadeh [1], the concept of fuzzy set concept and there after it has been developed by several authors through the contribution of the different articles on this concept and applied on different branches of pure and applied mathematics. In [4],[5], [7] ,[8],[9],[10], [19] &[20], Elementary calculus of fuzzy sets and systems and the basic fuzzy idea of triangular fuzzy numbers have applied in literature that includes the applying of fuzzy sets to pattern recognition, judgment issues, perform approximation, system theory, logical system, fuzzy algorithms, fuzzy automata, fuzzy grammars, fuzzy language, fuzzy mathematics, fuzzy topology, etc. during this note, our interests are in the study of certain concepts in triangular fuzzy linear circuit.

For every electrical circuit, there are two or more independent supplies like current, voltage or both the sources. For examining these electrical circuits, the superposition theorem is widely utilized and mostly for time-domain circuits at various frequencies. For instance, a linear DC circuit consists of one or more independent supply; we can get the supplies like voltage and current by using methods like mesh analysis and nodal analysis techniques

2. PRELIMINARIES

The preliminary segment, The Fuzzy numbers are the great consequence of fuzzy systems. Regularly used the fuzzy numbers in applications of the triangular fuzzy number. [4],[5], [7] ,[8],[9],[10], [19] &[20],

2.1 **Definition 1:** [5]

A fuzzy number is a set similar $v : R \to I = [0,1]$ which satisfies [8 – 12],

1. Upper semi continuous function is v.
2. Outside of the interval [c,d] is $v(x) = 0$.
3. There exists a real numbers a, b such that $c \le a \le b \le d$ and
   3.1 The monotonically increasing function $v(x) \in$ [c, a].
   3.2 The monotonically decreasing function $v(x) \in$ [b, d].
   3.3 $v(x) = 1$, $x \in [a,b]$.

It is denoted by $F(\Re)$.

Arithmetic operations among two triangular fuzzy numbers defined on universal set of real numbers $F(\Re)$ are reviewed [4].

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2.2 Fuzzy set: [1]

A fuzzy set L must the three axioms,

i . $\tilde{L}$ is a ordinary set.

ii. ${}^{\alpha}\tilde{L}$ is closed interval , for all $\alpha \in [0,1]$

iii. $\tilde{L}$, ${}^{0+}\tilde{L}$ is bounded.

2.3 Triangular Fuzzy Number: [4], [8-12]

A fuzzy numbers delineated with three points as: $\tilde{L} = (l_1 , \ l_2 , \ l_3)$

This illustration is taken as membership rule and holds the subsequent axioms

(i) Increasing function is l_1 to l_2

(ii) Decreasing function is l_2 to l_3

(iii) $l_1 \leq l_2 \leq l_3$

$$\mu_L(x) = \begin{cases} 0, & for \ x < l_1 \\ \dfrac{x - l_1}{l_2 - l_1} & for \ l_1 < x < l_2 \\ \dfrac{l_3 - x}{l_3 - l_1} & for \ l_2 < x < l_3 \\ 0, & for \, x > l_3 \end{cases}$$

2\. 4. A Triangular fuzzy number is positive is defined as $\tilde{L} = (l_1 , \ l_2 , \ l_3)$, here

2.5. A Triangular fuzzy number is negative is defined as $\tilde{L} = (l_1 , \ l_2 , \ l_3)$, here

2.6. Two triangular fuzzy numbers $\tilde{L}$ and $\tilde{M}$ are identically equal, that is $\tilde{L} = \tilde{M}$, if and only if $l_1 = m_1$ $l_2 = m_2$ and $l_3 = m_3$

3. Proposed Method

Superposition theorem for triangular fuzzy system.

In a linear fuzzy network containing more than one independent triangular fuzzy source and dependent fuzzy source, then result current in any element is the algebraic sum of the current that would be produced by each independent fuzzy source acting alone all the other independent sources being represented meanwhile by their respective internal resistances.

The independent voltage sources are represented by their internal resistance if given or simply with zero resistances (i.e) short circuits if internal resistances are not mentioned. The independent current sources are represented by infinite resistances. That is open circuits. The dependent sources are

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not sources but dissipative components. Hence they are active at all times. A dependent sources has zero value only when its control voltage or current is zero.

A linear network is one whose parameters are constant. That is do not change with voltage and current.

Procedure for Superposition Theorem of fuzzy system

The Following steps in order to find the response in a particular fuzzy branch using superposition theorem of fuzzy systems. Here especially we have use triangular fuzzy systems.

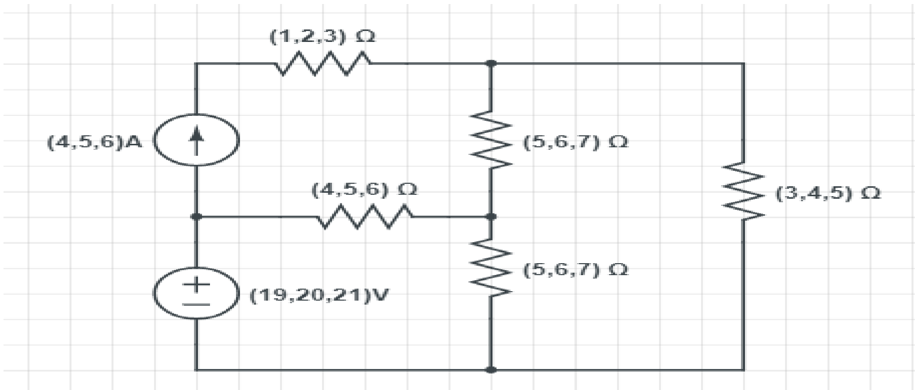
Step 1 − Find the current through the resistance when only one independent source is acting, replacing all other independent sources by respective internal resistance.

Step 2 – Find the current through the resistance for each of the independent sources.

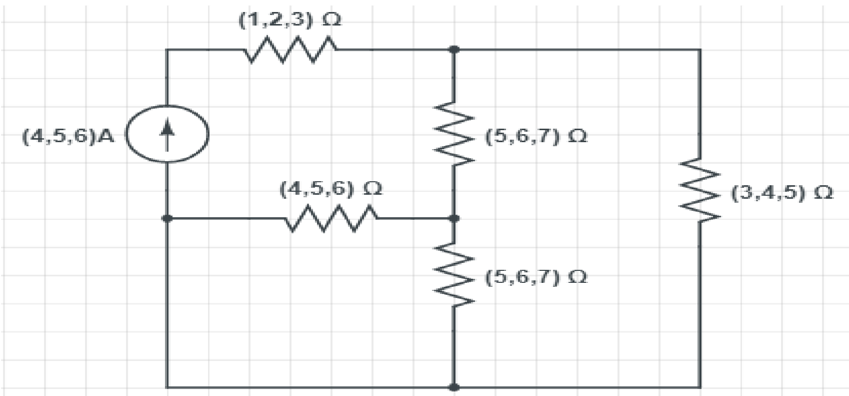
Step 3 – Find the resultant current through the resistance by the superposition theorem considering magnitude and the direction of each current.

4. Numerical Illustrations:

Consider the triangular fuzzy circuit to which we are going to determine the current I through the (2, 4, 6) ohm resistor using superposition theorem for fuzzy system.



When the (19 20 21) V source is acting alone



By series parallel reduction technic

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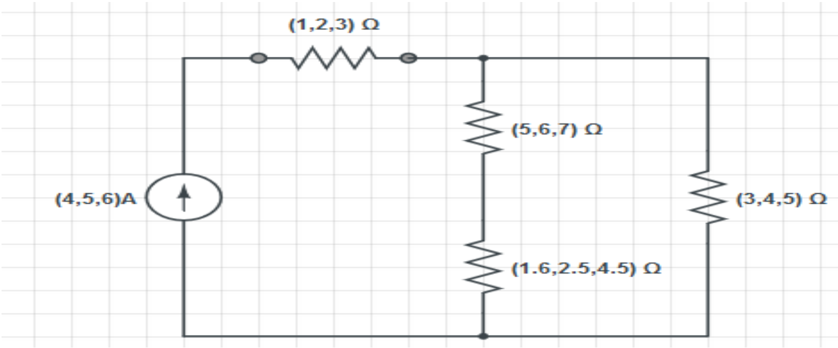
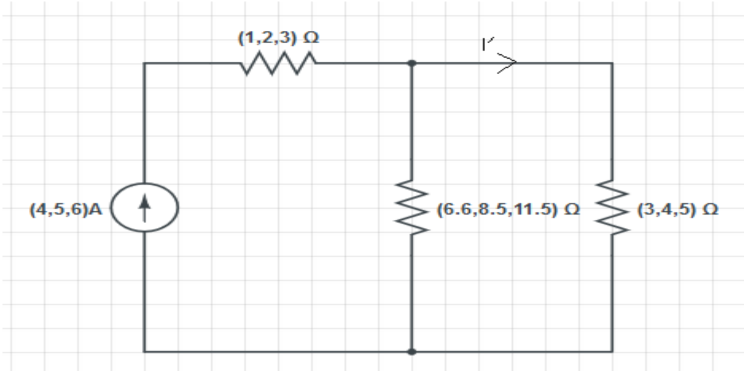
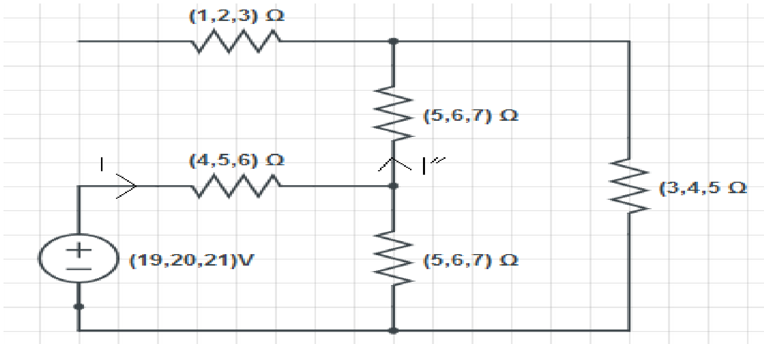




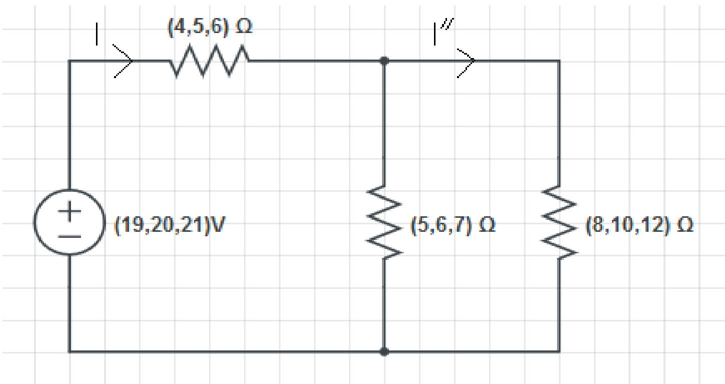
$$I' = (4,5,6) \times \frac{(6.6,8.5,11.5)}{(6.6,8.5,11.5) + (3,4,5)}$$

$$I' = (1.52,3.4,7.14)$$

When the (19, 20, 21) V source is acting alone



By series-parallel reduction technique



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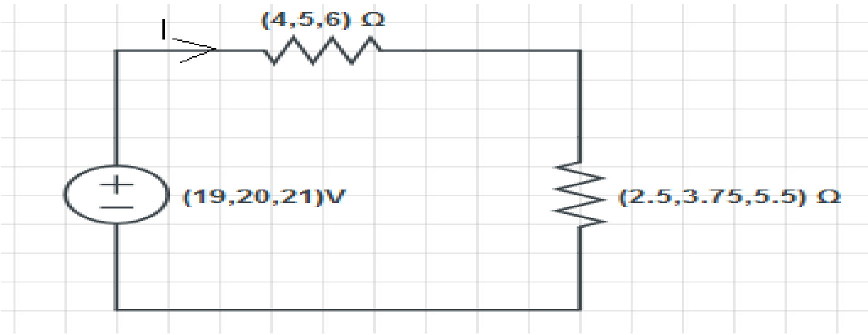

$$I = \frac{(19,20,21)}{(4,5,6)+(2.5,3.75,5.5)} = (1.65,2.29,3.23)$$

By current division rule,

$$I'' = (1.65,2.29,3.23) \times \frac{(5,6,7)}{(5,6,7)+(8,10,12)} = (0.42,0.84,1.71)$$

$$I = I' + I''$$

= (2.5, 3.75, 5.5) + (0.42, 0.84, 1.71)

= (2.92, 4.59, 7.21)

5. Conclusion:

The superposition theorem of fuzzy system is suitable for working on the principle of fuzzy linear system. Here the triangular fuzzy system used to find the power calculation is more accuracy for calculus methods and also the power equation is not linear. The application of superposition theorem is, very useful service only for linear circuits as well as the circuit which has more accuracy of supplies.

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