International Journal of Multidisciplinary Research and Growth Evaluation

Research and Growth Evaluation

International Journal of Multidisciplinary Research and Growth Evaluation
ISSN: 2582-7138
Received: 15-10-2021; Accepted: 18-11-2021
www.allmultidisciplinaryjournal.com
Volume 2; Issue 6; November-December 2021; Page No. 381-384

# Some results on strong neutrosophic edge bi-magic hyper graphs

**S Vimala**
Assistant Professor, Department of Mathematics, Mother Teresa Women's University, Kodaikanal, Tamil Nadu, India

Corresponding Author: **S Vimala**

**Abstract**
In 2015 Vasantha K, Ilanthenral.K and Florentin Smarandache introduced new dimension of graph theory: Neutrosophic Graphs. In the same time [5] proved basic results in certain types of Neutrosophic graphs. This paper the concept of Edge Bi – magic labelling in Strong Neutrosophic Hyper Graphs are introduced. Some interesting properties of strong Neutrosophic graphs are studied. Investigation of this topic on Windmill Graph, House Graph, and Tetrahedral Graph are Neutrosophic Edge Bi –magic Hyper Graphs has been done.

**Keywords:** Edge Bi – magic labelling, Hyper Graph, Windmill Graph, Tetrahedral Graph, House Graph

## 1. Introduction

One of the notable mathematical inventions of the 20th century is that of fuzzy sets by Lotfi. A. Zadeh in 1965 [13]. Most graph labelling methods trace their origin to one introduce by Rosa in [10] in 1967, or one given by Graham and Sloane [7] in1980. Rosa called a function $f(a)$ β-valuation of a graph G with q edges if f is an injection from the vertices of G to the set {0,1,…q} such that, when each $xy$ is assigned the label $|f(x) - f(y)|$, the resulting edge labels are distinct. Golomb [8] subsequently called such labelling graceful and this is now the popular term. In the history of mathematics, the solution given by Euler of the well-known Konogsberg bridge problem is considered to be the first theorem of graph theory. This has now become a subject generally regarded as a branch of combinatorices. A graph represents a particular relationship between elements of a set V. It gives an idea about the extent of the relationship between any two elements of V. Fuzzy graph models are more helpful and realistic in natural situations. Atanassov [1] added a new component (which determines the degree of non- membership) the definition of fuzzy sets. The concept of Neutrosophic set was introduced by F. Smarandache [11] which is a mathematical tool for handling problems involving imprecise, indeterminacy and inconsistent data. We were inspired by the well-known concept of a magic square to introduce the so called magic graphs. Detailed description of these graphs was given by B.M. Stewart [12] and there also exist further papers dealing with magic graphs.

In 2004 Baskar Babujee [2] and [3] introduced the notion of vertex-bimagic labeling in which there exist two constants $k_1$ and $k_2$ such that the sums involved in a specified type of magic labeling is $k_1$ or $k_2$. Bertault and eades [4] show how to create subset-based hyper graph drawings. An edge-based hyper graph drawing resembles standard drawings of graphs more closely. A hyper graph is planar if only if it has as edge-based drawing without hyper edge crossings [6].

## 2. Preliminaries

### Definition 2.1[6]

Windmill graph Wd (k, n) is an undirected graph constructed for $k \geq 2$ and $n \geq 2$ by joining n copies of the complete graph $k_n$ at a shared universal vertex.

### Definition 2.2[6]

A tetrahedral graph may be defined as a graph G, whose vertices may be identified with the n(n-1)(n-2)/6 unordered triplets on n symbols, such that two vertices are adjacent if and only if the corresponding triplets have two symbols in common.

### Definition 2.3[6]

The house graph is simple graph 5 nodes and 6 edges, illustrated in two embeddings, whose name derives from its resemblance to a schematic illustration of a house with a roof.

**Definition 2.4** [6]

A magic graph is a graph whose edges are labelled by positive integers. So that the sum over the edges incident with any vertex is the sum is the same, independent of the choice of vertex.

**Definition 2.5** [6]

A graph G is said to be a bi-magic graph if the sum of the labels on the edges incident at the vertices are $k_1$ and $k_2$, where $k_1$ and $k_2$ are constants.

**Definition 2.6** [5]

An intuitionistic fuzzy graph is of the form G = (V, E) where V = { $v_1, v_2, \ldots v_n$} such that $\mu_1 : V \to [0,1]$ and $\gamma_1 : V \to [0,1]$ denote the degree of membership and non-membership of the elements $v_i \in V$ respectively, and

$0 \le \mu_1(v_i) + \gamma_1(v_i) \le 1$.

$E \subseteq V \times V$ where $\mu_2: V \times V \to [0, 1]$ and $\gamma_2: V \times V \to [0, 1]$ are such that

$\mu_2(v_i, v_j) \le \min\{\mu_1(v_i), \mu_1(v_j)\}$

$\gamma_2(v_i, v_j) \le \max\{\gamma_1(v_i), \gamma_1(v_j)\}$

and $0 \le \mu_2(v_i, v_j) + \gamma_2(v_i, v_j) \le 1$ for every $(v_i, v_j) \in E$, i, j = 1, 2, ..., n.

**Definition 2.7** [6]

A hypergraph H is a pair H = (X, E), where X is a set of elements called nodes or vertices, and E is a set of non – empty subsets of X called hyperedges or edges.

**Definition 2.8** [9]

A SVN graph is said to be a single valued neutrosophic bi-magic graph if $\widetilde{Bm_\tau}(G) = T_A(u) + T_B(u,v) + T_A(v)$, $\widetilde{Bm_I}(G) = I_A(u) + I_B(u,v) + I_A(v)$ and $\widetilde{Bm_F}(G) = F_A(u) + F_B(u,v) + F_A(v)$ has two different neutrosophic magic values $\widetilde{Bm_1}(G)$, $\widetilde{Bm_2}(G)$ for all u, v ∈ V. where $\widetilde{Bm_1}(G) = (\widetilde{Bm_{\tau1}}(G), \widetilde{Bm_{I1}}(G), \widetilde{Bm_{F1}}(G))$ and $\widetilde{Bm_2}(G) = (\widetilde{Bm_{\tau2}}(G), \widetilde{Bm_{I2}}(G), \widetilde{Bm_{F2}}(G))$.

Bi magic labelling of SVN graph G is $\widetilde{Bm_o}(G) = (\widetilde{Bm_1}(G), \widetilde{Bm_2}(G))$.

## 3. Strong Neutrosophic Edge BI – Magic Hyper Graphs

**Definition 3.1**

A Strong Neutrosophic Edge Bi- Magic Graph is a Strong Neutrosophic Edge Bi-Magic Hyper Graph in which every pair of distinct vertices H = (V, E) is in at most one Neutrosophic Bi - Magic hyperedge of H.

**Theorem 3.2**

Let G = (V, E) be a windmill graph. Then G is a Strong Neutrosophic edge bi- magic hyper graph.

**Proof**

Let G be the graph with n vertices, and m edges.

Assume that the function,

$T_A: V \to [0,1]$, $I_A : V \to [0,1]$, $F_A : V \to [0,1]$ denoted the degree of membership and, degree of indeterminacy, degree of false membership.

$0 \le T_A(V_i) + I_A(V_i) + F_A(V_i) \le 3$.

$T_B\ E \subseteq V \times V \to [0,1]$, $I_B : E \subseteq V \times V \to [0,1]$, $F_B: E \subseteq V \times V \to [0,1]$

$T_B(v_i, v_j) \le \min[T_A(v_i), T_A(v_j)]$,

$I_B(v_i, v_j) \le \min[I_A(v_i), I_A(v_j)]$

$F_B(v_i, v_j) \le \max[F_A(v_i), F_A(v_j)]$

A windmill graph is said to be Strong Neutrosophic edge bi – magic graph if,

$\widetilde{Bm_\tau}(G) = T_A(u) + T_B(u,v) + T_A(v)$,

$\widetilde{Bm_I}(G) = I_A(u) + I_B(u,v) + I_A(v)$

$\widetilde{Bm_F}(G) = F_A(u) + F_B(u,v) + F_A(v)$

Edge bi – magic labelling of Neutrosophic graph is,

$\widetilde{Bm_o}(G) = (\widetilde{Bm_1}(G), \widetilde{Bm_2}(G))$

Then $\widetilde{Bm_1}(G) = (0.33, 0.033, 0.0033)$ and $\widetilde{Bm_2}(G) = (0.28, 0.028, 0.0028)$

$\widetilde{Bm_o}(G) = (0.33, 0.28)$

Then Neutrosophic edge bi- magic windmill graph is an hyper graph.

A hyper graph G can also be drawn as a bipartite graph where one set of vertices corresponds to the vertices of G and the other corresponds to the hyper graph.

**Example: 3.3**

Windmill graph (**$W^2_3$**), is a strong neutrosophic edge bi – magic graph.

$\widetilde{Bm_1}(G) = (0.33, 0.033, 0.0033)$ and $\widetilde{Bm_2}(G) = (0.28, 0.028, 0.0028)$

$\widetilde{Bm_o}(G) = (0.33, 0.28)$

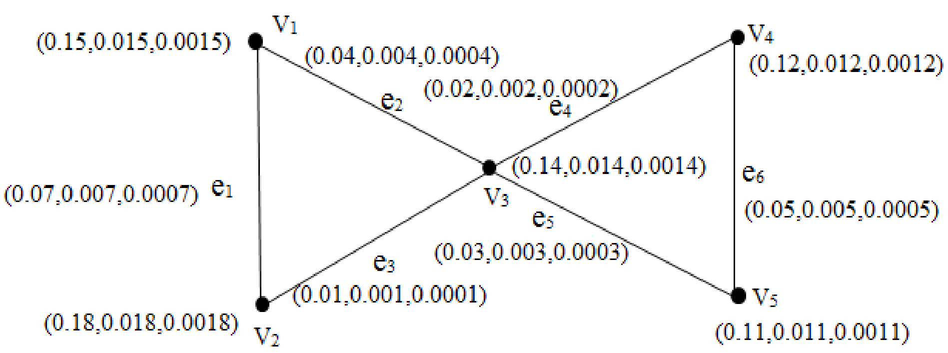


**Fig 1:** Windmill Bi-Magic Graph

$\widetilde{Bm_1}(G) = (0.33, 0.033, 0.0033)$ and $\widetilde{Bm_2}(G) = (0.28, 0.028, 0.0028)$

Neutrosophic edge bi – magic hyper graph,

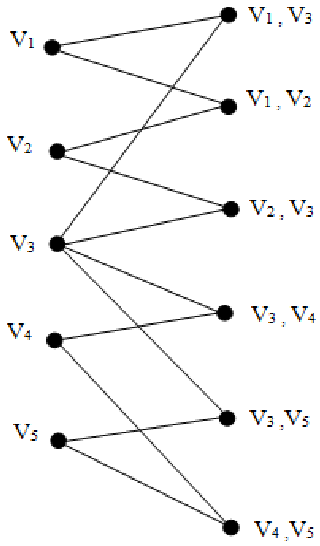


**Fig 2:** Windmill Bi – Magic Hyper Graph

From figure,
Vertices = {$V_1$, $V_2$, $V_3$, $V_4$, $V_5$}
Vertex hyper edges = {$e_1$, $e_2$, $e_3$, $e_4$, $e_5$, $e_6$}.

**Example: 3.4**

House Graph is a neutrosophic edge bi – magic graph.
$\widetilde{Bm_1}$(G) = (0.42, 0.042, 0.0042) and $\widetilde{Bm_2}$(G) = (0.33, 0.033, 0.0033)
$\widetilde{Bm_o}$(G) = (0.42, 0.33)

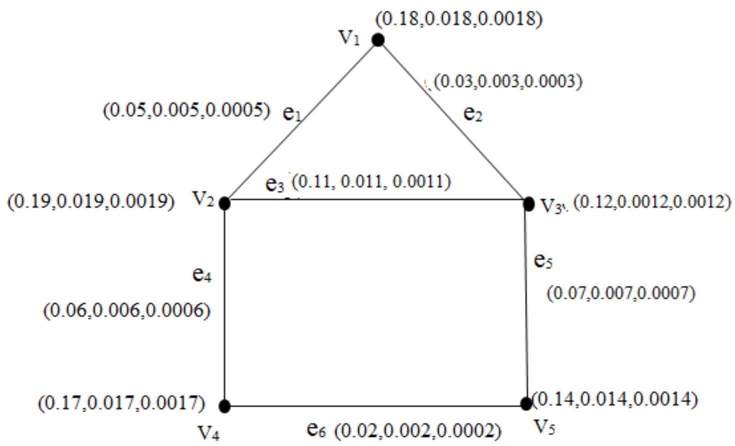


**Fig 3:** House Bi – Magic Graph

$\widetilde{Bm_1}$(G) = (0.42, 0.042, 0.0042) and $\widetilde{Bm_2}$(G) = (0.33, 0.033, 0.0033)

Neutrosophic edge bi – magic hyper graph,

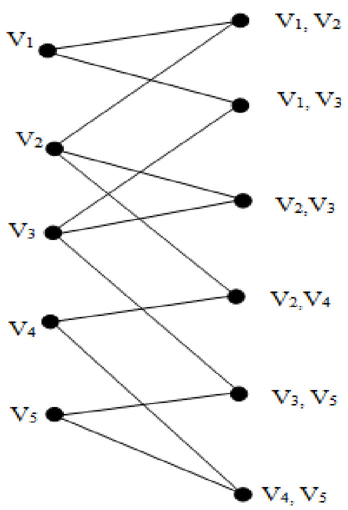


**Fig 4:** House Bi – Magic Hyper Graph

From figure,
Vertices = $\{V_1, V_2, V_3, V_4, V_5\}$
Vertex hyper edges = $\{e_1, e_2, e_3, e_4, e_5, e_6\}$.

**Example: 3.5**

Tetrahedral Graph is a neutrosophic edge bi – magic graph.
$\widetilde{Bm_1}$(G) = (0.46, 0.046, 0.0046) and $\widetilde{Bm_2}$(G) = (0.36, 0.036, 0.0036)
$\widetilde{Bm_o}$(G) = (0.46, 0.36)

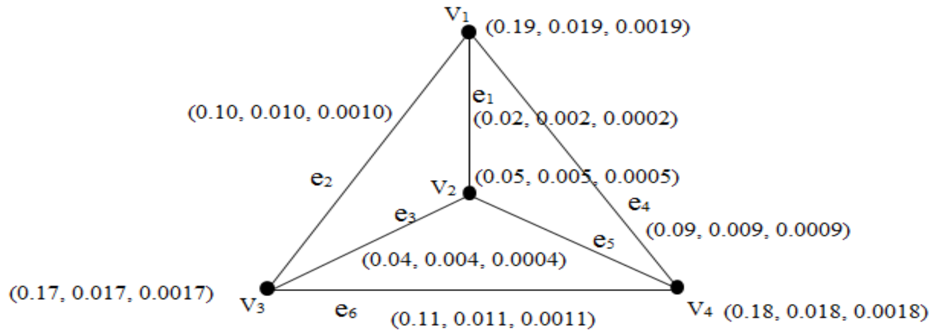


**Fig 5:** Tetrahedral Bi – Magic Graph

$\widetilde{Bm_1}$(G) = (0.46, 0.046, 0.0046) and $\widetilde{Bm_2}$(G) = (0.36, 0.036, 0.0036)
Neutrosophic edge bi – magic hyper graph,

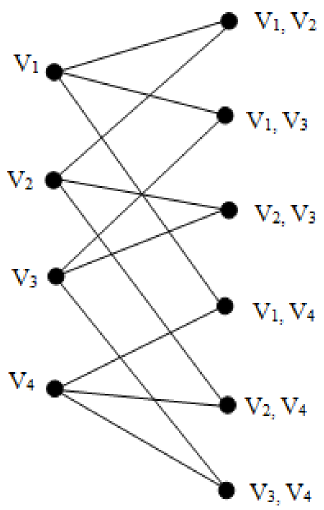


**Fig 6:** Tetrahedral Bi – Magic Hyper Graph

From figure,
Vertices = $\{V_1, V_2, V_3, V_4, V_5\}$
Vertex hyper edges = $\{e_1, e_2, e_3, e_4, e_5, e_6\}$.

## 4. Conclusion

Throughout this paper, Edge Bi – Magic Strong Neutrosophic Hyper Graphs were introduced and defined. And these concepts applied to Windmill Graph, House Graph, and Tetrahedral Graph. Our future proposed work is to apply on different types of Neutrosophic hyper graphs and their applications are in technologies, communication networks, astronomy, Circuit design and database management will be developed on future purpose. The applications of edge bi - magic labeling is used in technologies, communication networks, astronomy, and circuit design and database management.

## 5. References

1. Atanassov KT, Shannon A. A first step to a theory of Intuitionistic Fuzzy Graph. In: Lakav D, editor. Proceedings of the first workshop on fuzzy based Expert system. Sofia. 1994; 28-30:59-61.
2. Baskar Babujee J. Bimagic labelling in path graphs. Math Education. 2004; 38:12-16.
3. Baskar Babujee J. On edge bimagic labelling. J Combin Inf Syst Sci. 2004; 28:239-244.
4. Bertault F, Eades P. Drawing hypergraphs in the subset standard. In: GD 2000.
5. Dhavaseelan R, Vikramaprasad R, V. Krishnaraj. Certain Types of Neutrosophic Graphs. Int Jr Math Sci Appl. 2015, 5(2).
6. Gallian JA. Dynamic Survey DS6: Graph Labelling. Electron J Combin. 2007; DS6:1-58.
7. Graham RL, Sloane NJA. On additive bases and harmonious graphs. SIAM J Alg Discrete Methods, 1980, 1.
8. Golomb SW. How to number a graph. In: Graph Theory and Computing. Read RC, editor. New York: Academic Press; 1972.
9. Krishnaraj V, Vikramaprasad R. Some Results on Single Valued Neutrosophic Bi-Magic Graphs. Int J Mech Eng Technol. 2018; 9(2):398-408.
10. Rosa A. On certain valuation of the vertices of a graph. In: Theory of Graphs. International symposium, Rome; July 1966.
11. Smarandache F. Neutrosophy and Neutrosophic Logic. First International Conference on Neutrosophy, Neutrosophic Logic, Set, Probability and Statistic. University of New Mexico, Gallup, NM 87301, USA; 2002.
12. Steward BM. Magic graphs. Can J Math. 1966; 18:1031-1059.
13. Zadeh LA. Fuzzy sets. Information Control. 1965; 8:338-353.
14. Vasantha K, Ilanthenral K, Smarandache F. Neutrosophic Graphs: A New Dimension to Graph Theory. EuropaNova ASBL, 2015.