Library Progress International
Vol.43, No.2, Jul-Dec 2023: P.498-502

Print version ISSN 0970 1052
Online version ISSN 2320 317X

Original Article

Available online at www.bpasjournals.com

Edge Version Of Forgotten Polynomial Of Certain Graphs

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How to cite this article: Dr. D. Ahila jeyanthi (2023). Edge Version Of Forgotten Polynomial Of Certain Graphs. *Library Progress International,* 43(2), 498-502

ABSTRACT : In this paper we characterize the edge rendition of forgotten polynomial of a graphs G. We figured express recipes for the edge variant of forgotten polynomial of numerous notable classes of graphs.
AMS Mathematics Subject Classification : 05C07, 05C90.

Key words : Topological indices, line graph

Introduction

Let G be a simple graph, with vertex set V (G) and edge set E(G). The degree $d_v$of a vertex v is the number of vertices joining to v and the degree of an edge $e \in E(G)$,d_e is the number of its adjacent vertices in V (L(G)), where L(G) is the line graph ofa graph G which is defined as the graph whose vertices are the edges of G, with two vertices are adjacent if the corresponding edges have one vertex basic in G.

Line graphs are extremely valuable in primary science, yet as of late they wereviewed as almost no in substance graph hypothesis. In 1981, Bertz presented the main topological file based on the line graph in [1], when he was chipping awayat sub-atomic fanning. After that numerous topological indices dependent on line graphs were presented (see [4, 5]). For additional insights regarding the applications of line graphs in science, we allude the articles (see [2, 5,7 8,9]). In science, sub- atomic construction descriptors are utilized to demonstrate data of molecules, which are known as topological indices. They are invariant under graph isomorphisms. Thereare numerous topological indices characterized on the premise of the vertex-degrees of graphs. In 2015

Furtla and Gutman introduced another topological index called Forgotten index or F index $F(G) = \sum_{uv \in G} x\ [{d_u}^2 + {d_v}^2]$. The Forgotten polynomial [10] of a graph G is defined as $F(G,x) = \sum_{uv \in G} x^{[{d_u}^2 + {d_v}^2]}$. The relation between forgotten index and forgotten polynomial is established as $\int_0^1 F(G,x)dx$.

Lemma 1. Let G be graph with $u, v \in V(G)$ and $e = uv \in E(G)$. Then $d_e = d_u + d_v - 2$.
In order to calculate the number of edges of an arbitrarygraph, the following lemma is significant for us.
Lemma 2. Let G be a graph. Then $\sum_{v \in V(G)} d_u = 2|E(G)|$.

This is also known as handshaking Lemma.

2. Main Result

Proposition 1. Let G be a k-regular graph of n vertices, then $F_e(G,x) = \frac{kn}{2}(k-1)x^{8k^2-16k+8}$.

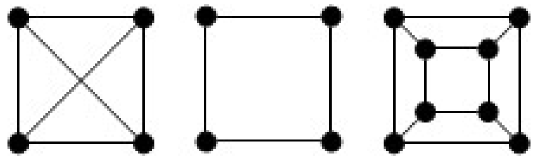

Figure 1

Proof. Since G is a k- regular graph, then each vertex of G has degree k and by Lemma 2 we have $\frac{kn}{2}$ edges. Therefore in L(G) we have $\frac{kn}{2}$ edges. Therefore in L(G) we have $\frac{kn}{2}$ vertices and by using Lemma 1, all the vertices have degree $2k -$

2. Lemma 2 implies that we have $\frac{kn(k-1)}{2}$ edges in L(G). Consequently we get $F_e(G,x) = \frac{kn}{2}(k-1)x^{8k^2-16k+8}$.

Let K_n, C_n and $\prod_n$ denotes the complete graph on n vertices, the cycle on nvertices and the n-sided prism as shown in Figure 1.

Proposition 2.

1. $F_e(K_n,x) = \frac{n(n-1)}{2}x^{2[(n-1)^2]}$
2. $F_e(C_n,x) = nx^8$
3. $F_e(\prod_n) = 3nx^{18}$

Proof. This proof can be obtained by using Proposition 1.

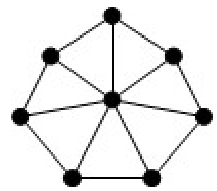

Figure 2

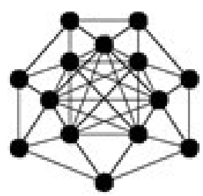

Figure 3

Proposition 3. Let W_n be a graph of wheel, then $F_e(W_n,x) = nx^{16} + \frac{n(n-1)}{2}x^{2n^2+4n+2} + 2nx^{n^2+2n+17}$.

Proof. In the wheel graph W_n, the total number of vertices and edges are $n+1$ and $2n$ respectively (see Fig. 2). Therefore in $L(W_n)$ the total number of vertices are 2*n*, out of which n vertices of degree 4 and remaining n vertices of degree n+1 (see Fig. 3). It is easily seen from Lemma 2 that the total number of edges in $L(W_n)$ are $n(n+5)$. The edge partition of $E(L(W_n))$ based on the degree of the vertices is shown in Table 1.

Table 1: Edge Partition of $L(W_n)$

$(d_u, d_v) \in E(L(G))$	$(4,4)$	$(n+1, n+1)$	$(4, n+1)$
Number of edges	n	2 $\frac{n(n-1)}{}$	2n

Hence we get $F_e(W_n,x) = nx^{16} + \frac{n(n-1)}{2}x^{2n^2+4n+2} + 2nx^{n^2+2n+1}$.

Proposition 4. Let H_n be a graph of Helm, then $F_e(H_n,x) = 2nx^{45} + 2nx^{n^2+4n+40} + \frac{n(n-1)}{2}x^{2n^2+8n+8} + nx^{n^2+4n+13} + nx^{72}$.

Proof: In the Helm graph H_n, the total number of vertices and edges are $2n+1$ and 3n respectively (see Fig.5). Therefore in $L(H_n)$, the total number of vertices are 3n, out of which n vertices of degree 3, n vertices of degree 6 and n vertices of degree n+2 (see Fig.4). It is easily seen from Lemma 2 that the total number of edges in $L(H_n)$ based on the degree of the vertices is shown in Table 2.

Table 2: The Edge Partition of $L(H_n)$

$(d_u, d_v) \in E(L(G))$	$(3,6)$	$(6, n+2)$	$(n+2, n+2)$	$(3, n+2)$	$(6,6)$
Number of edges	2n	2n	$\frac{n(n-1)}{2}$	n	n

Hence we get $F_e(H_n, x) = 2nx^{45} + 2nx^{n^2+4n+40} + \frac{n(n-1)}{2}x^{2n^2+8n+8} + nx^{n^2+4n+13} + nx^{72}.$

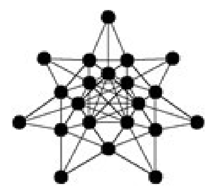

Figure 4

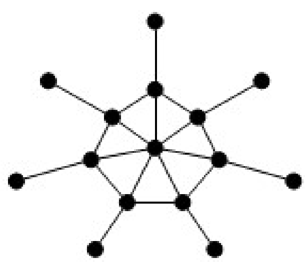

Figure 5

Proposition 5. Let L_n be a graph of ladder,then

$$F_e(L_n, x) = \begin{cases} 4x^{13} + 2x^{18} + 4x^{25} & if\ n > 2 \\ (6n-14)x^{32} + 8x^{25} + 4x^{13}, & n = 2 \end{cases}$$

Proof: The ladder graph L_n for $n = 1$ is a cycle C_4 which is known from proposition 1. For L_2 we have edge partition of $E(L(L_2))$ based on the degree of the vertices is shown in Table 3.

Table 3: The Edge Partition of $L(L_2)$

$(d_u, d_v) \in E(L(G))$	$(2,3)$	$(3,3)$	$(3,4)$
Number of edges	4	2	4

In the ladder graph L_n for $n > 2$, the total number of vertices and edges are $2n + 2$ and $3n + 1$ respectively (see Fig 6). Therefore in $L(L_n)$ the total number of vertices are $3n + 1$ out of which 2 vertices of degree 2, 4 vertices of degree 3 and $3n - 5$ vertices degree 4 (see Fig.7). It is easily seen from Lemma 2 that the total number of edges is $L(L_n)$ based on the degree of the vertices shown in Table 4.

Table 4: The Edge Partition of $L(L_n)$

$(d_u, d_v) \in E\ (L\ (G))$	(2,3)	(3,4)	(4,4)
Number of edges	4	8	6n-14

Consequently, we get $F_e(L_n, x) = (6n - 14)x^{32} + 8x^{25} + 4x^{13}$.

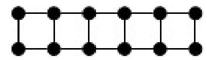

Figure 6

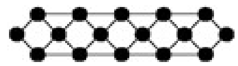

Figure 7

In chemistry, the pentacene compound is a hydrocarbon consists of five benzenerings. It is purple powder organic semiconductor and gradually degrades when exposedto light and air. The linear [n]-Pentacene P_n **for** $n = 2$ **is shown in Fig. 8.**

Proposition 6. Let P_n **be a graph of linear** $[n]-$**pentacene, then** $F_e(P_n, x) = 4x^8 + (18n - 4)x^{18} + (24n - 8)x^{25} + 4(n - 1)x^{32}$.

Proof: In the pentacene graph P_n **the total number of vertices and edges are** $22n$ **and** $28n - 2$ **respectively (see Fig. 8). Therefore in line graph** $L(P_n)$ **the total number ofvertices are** $28n - 2$ **out of which 6 vertices are of degree 2,** $20n - 4$ **vertices are of degree 3 and** $8n - 4$ **vertices are of degree 4 (see Fig. 9). It is easily seen from Lemma 2 that the total number of edges in** $L(P_n)$ **are** $46n - 8$**. The edge partition of** $E(L(P_n))$ **based on the degree of the vertices in shown in Table 5.**

Table 5: The Edge Partition of $L(P_n)$

$(d_u, d_v) \in E\ (L\ (G))$	(2,2)	(2,3)	(3,3)	(3,4)	(4,4)
Number of edges	4	4	18n-4	24n-8	$4\,(n-1)$

Hence we get $F_e(P_n, x) = 4x^8 + (18n - 4)x^{18} + (24n - 8)x^{25} + 4(n - 1)x^{32}$.

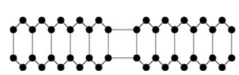

Figure.8

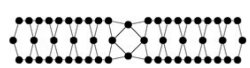

Figure.9

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