

## Variation density of chaotic graphs

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**Abstract:** In this paper we will introduce a new type of graphs which carry physical character called density of chaotic graphs, we will discuss the density of chaotic graphs at two different cases, equal densities and different densities. The representation of the chaotic graphs by matrices will be obtained.

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### Definition and background:

1-Abstract graphs: An abstract graph  $G$  is a diagram consisting of a finite non empty set of the elements, called "vertices" denoted by  $V(G)$  together with a set of unordered pairs of these elements, called " edges " denoted by  $E(G)$ . The set of vertices of the graph  $G$  is called "the vertex set of  $G$ " and the list of edges is called "the edge-list of  $G$ " [1,2].

2-Adjacency and incidence: Let  $v$  and  $w$  be vertices of a graph, if  $v$  and  $w$  are joined by an edge  $e$ , then  $v$  and  $w$  are said to be adjacent. Moreover,  $v$  and  $w$  are said to be incident with  $e$ , and  $e$  is said to be incident with  $v$  and  $w$  [3].

3-The adjacency matrix: Let  $G$  be a graph without loops, with  $n$ -vertices labeled  $1, 2, 3, \dots, n$ , the adjacency matrix  $A(G)$  is the  $n \times n$  matrix in which the entry in row  $i$  and column  $j$  is the number of edges joining the vertices  $i$  and  $j$  [3].

4-The incidence matrix: Let  $G$  be a graph without loops, with  $n$ -vertices labeled  $1, 2, 3, \dots, n$ , and  $m$  edges labeled  $1, 2, 3, \dots, m$ , the incidence matrix  $I(G)$  is the  $n \times m$  matrix in which the entry in row  $i$  and column  $j$  is  $1$  if vertex  $i$  is incident with edge  $j$  and  $0$  otherwise [4,5]. 2000 mathematics subject classification 51H10,57N10

5-Chaotic graphs: A "chaotic" graph is a geometric graph that carries many physical characters [2].

6-Density: Is a physical property of matter, as each element and compound has a unique density associated with it [6].