MATCH
Communications in Mathematical
and in Computer Chemistry

MATCH Commun. Math. Comput. Chem. **88** (2022) 233-234
ISSN: 0340-6253
doi: 10.46793/match.88-1.233R

BOOK REVIEW

Irregularity in Graphs

by

Akbar Ali, Gary Chartrand and Ping Zhang

SpringerBriefs in Mathematics, 2021, Switzerland, X+107 pp.,
ISBN 978-3-030-67992-7, ISBN 978-3-030-679923-4 (eBook)
doi.org/10.1007/978-3-030-67993-4

There are numerous papers regularity and irregularity of graphs. However, this book can be considered as the first overall monograph dealing with various theoretical aspects of graph irregularity problems. A novelty of the approach used is that the notion of graph irregularity is interpreted in a more general context. This means that the problem of graph irregularity is investigated from several possible, not usual approaches.

The concept followed by the authors is based not only on the characterization of the different degree distributions but involves the detailed study of vertex- and edge-coloring and identifying the different subgraph decompositions of graphs.

The book consists of a Preface and 8 chapters. The authors of different chapters are not revealed. In the Preface, the contents of 8 chapters are briefly presented, all of them are related to various versions of interpretations of graph irregularity.

Chapter 1: *Introduction* (pp. 1 – 12). It contains the basic notions and definitions, moreover some relevant theories dealing with fundamental properties of regular and non-regular graphs. According to the traditional concept, regular graphs have the same degree, i.e., their degree sets consist exactly of a single integer, while a graph is non-regular if it contains at least to vertices of different degree.

Chapter 2: *Locally Irregular Graphs* (pp. 13 – 26). It is focused on the highly irregular and link-irregular graphs, where the degrees of the neighbors or the structure of the subgraphs induced by the neighbors of a vertex are investigated.

Chapter 3: *F-Irregular Graphs* (pp. 27 – 32). The concept of *F*-irregular graphs is based on the re-interpreting what is meant by the degree of a vertex. This extended irregularity concept is illustrated on examples.

Chapter 4: *Irregularity Strength* (pp. 33 – 44). The irregularity strength of graphs is related to the notion of multigraphs and weighted graphs. This concept is based on the observation that the degree of a vertex in a graph can be defined in a more general manner. In a multigraph two distinct vertices are joined by more than one edge and the maximum number of edges that join any two distinct vertices is called the *strength* of the multigraphs.

Chapter 5: *Rainbow Mean Index* (pp. 47 – 61). Similarly to the procedure outlined in Chapter 4, the purpose of method presented in Chapter 5 is to minimize the resulting degrees (colors) of graph vertices, but with the requirement that all vertex colors must be integers.

Chapter 6: *Royal Colorings* (pp. 63 – 73). In this chapter, two similar procedures based on edge and vertex coloring techniques are outlined. The first method is referred to as the *majestic coloring* of graphs, the second as the *royal coloring*.

The final two chapters (7 and 8) deal with various irregularity phenomena in graphs describing what might be considered the opposite of regular characteristics of a graph.

Final remarks: The monograph focused primarily on the study of theoretical questions, presenting several relevant new results related to various interpretation of irregularity of a graph. Additionally, the book contains interesting open problems and conjectures. The readers are encouraged to study them. As can be observed, the authors do not deal with the practical application of graph irregularity indices, their characterization and comparative studies of these graph invariants are not considered in the monograph. It is expected that in a possible second enlarged edition of the book, a novel chapter on these graph invariants playing successful application in mathematical chemistry will be inserted.

PS. It is worth mentioning that all authors of the book are well-recognized members of the mathematics community. The Erdős-number of Prof. Gary Chartrand is equal to 1.

Tamás Réti