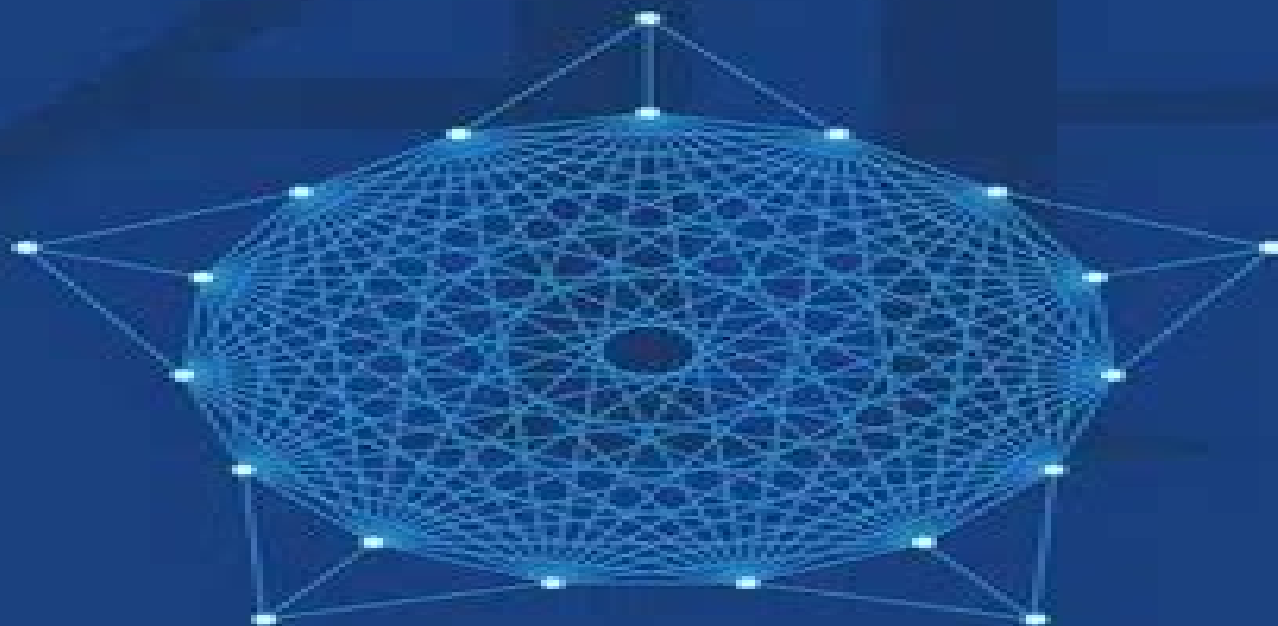# Spectral Radius of Graphs

Dragan Stevanović

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Zoran Stanić

Spectral Radius Of Graphs Dragan Stevanovic:

Spectral Radius of Graphs Dragan Stevanovic,2014-10-13 Spectral Radius of Graphs provides a thorough overview of important results on the spectral radius of adjacency matrix of graphs that have appeared in the literature in the preceding ten years most of them with proofs and including some previously unpublished results of the author The primer begins with a brief classical review in order to provide the reader with a foundation for the subsequent chapters Topics covered include spectral decomposition the Perron Frobenius theorem the Rayleigh quotient the Weyl inequalities and the Interlacing theorem From this introduction the book delves deeper into the properties of the principal eigenvector a critical subject as many of the results on the spectral radius of graphs rely on the properties of the principal eigenvector for their proofs A following chapter surveys spectral radius of special graphs covering multipartite graphs non regular graphs planar graphs threshold graphs and others Finally the work explores results on the structure of graphs having extreme spectral radius in classes of graphs defined by fixing the value of a particular integer valued graph invariant such as the diameter the radius the domination number the matching number the clique number the independence number the chromatic number or the sequence of vertex degrees Throughout the text includes the valuable addition of proofs to accompany the majority of presented results This enables the reader to learn tricks of the trade and easily see if some of the techniques apply to a current research problem without having to spend time on searching for the original articles The book also contains a handful of open problems on the topic that might provide initiative for the reader s research Dedicated coverage to one of the most prominent graph eigenvalues Proofs and open problems included for further study Overview of classical topics such as spectral decomposition the Perron Frobenius theorem the Rayleigh quotient the Weyl inequalities and the Interlacing theorem   Combinatorial Matrix Theory Richard A. Brualdi,Ángeles Carmona,P. van den Driessche,Stephen Kirkland,Dragan Stevanović,2018-03-31 This book contains the notes of the lectures delivered at an Advanced Course on Combinatorial Matrix Theory held at Centre de Recerca Matem tica CRM in Barcelona These notes correspond to five series of lectures The first series is dedicated to the study of several matrix classes defined combinatorially and was delivered by Richard A Brualdi The second one given by Pauline van den Driessche is concerned with the study of spectral properties of matrices with a given sign pattern Dragan Stevanovi delivered the third one devoted to describing the spectral radius of a graph as a tool to provide bounds of parameters related with properties of a graph The fourth lecture was delivered by Stephen Kirkland and is dedicated to the applications of the Group Inverse of the Laplacian matrix The last one given by ngeles Carmona focuses on boundary value problems on finite networks with special in depth on the M matrix inverse problem   **Matrix Inequalities for Iterative Systems** Hanjo Taubig,2017-02-03 The book reviews inequalities for weighted entry sums of matrix powers Applications range from mathematics and CS to pure sciences It unifies and generalizes several results for products and powers of sesquilinear forms derived from powers of Hermitian positive

semidefinite as well as nonnegative matrices It shows that some inequalities are valid only in specific cases How to translate the Hermitian matrix results into results for alternating powers of general rectangular matrices Inequalities that compare the powers of the row and column sums to the row and column sums of the matrix powers are refined for nonnegative matrices Lastly eigenvalue bounds and derive results for iterated kernels are improved   *Applications of Combinatorial Matrix Theory to Laplacian Matrices of Graphs* Jason J. Molitierno,2016-04-19 On the surface matrix theory and graph theory seem like very different branches of mathematics However adjacency Laplacian and incidence matrices are commonly used to represent graphs and many properties of matrices can give us useful information about the structure of graphs Applications of Combinatorial Matrix Theory to Laplacian Matrices o   **Bulletin - Académie serbe des sciences et des arts, Classe des sciences mathématiques et naturelles** Srpska akademija nauka i umetnosti. Odeljenje prirodno-matematičkih nauka,2015   **Mathematical Reviews** ,2005   **On the Spectral Radius of Graphs with a Given Domination Number** Dragan Stevanović,2007   *Graph Theory Notes of New York* ,2004   *The Minimum Spectral Radius of Graphs with a Given Clique Number* Dragan Stevanović,Pierre Hansen,Groupe d'études et de recherche en analyse des décisions (Montréal, Québec),2007   **The Minimal Spectral Radius of Graphs with a Given Diameter** E.R. van Dam,R.E. Kooij,2006   A Lower Bound for the Spectral Radius of Graphs with Fixed Diameter Sebastian Cioaba,Edwin van Dam,Jack Koolen,Jae-Ho Lee,2008 We determine a lower bound for the spectral radius of a graph in terms of the number of vertices and the diameter of the graph For the specific case of graphs with diameter three we give a slightly better bound We also construct families of graphs with small spectral radius thus obtaining asymptotic results showing that the bound is of the right order We also relate these results to the extremal degree diameter problem   Extremal Spectral Invariants of Graphs Robin Joshua Tobin,2017 We address several problems in spectral graph theory with a common theme of optimizing or computing a spectral graph invariant such as the spectral radius or spectral gap over some family of graphs In particular we study measures of graph irregularity we bound the adjacency spectral radius over all outerplanar and planar graphs and finally we determine the spectral gap of reversal graphs and a family of graphs that generalize the prefix reversal graph Firstly we study two measures of graph irregularity the principal ratio and the difference between the spectral radius of the adjacency matrix and the average degree For the principal ratio we show that the graphs which maximize this statistic are the kite graphs which are a clique with a pendant path when the number of vertices is sufficiently large This answers a conjecture of Cioab and Gregory For the second graph irregularity measure we show that the connected graphs which maximize it are pineapple graphs answering a conjecture of Aouchiche et al Secondly we investigate the maximum spectral radius of the adjacency matrix over all graphs on n vertices within certain well known graph families Our main result is showing that the planar graph on n vertices with maximal adjacency spectral radius is the join P 2 P n 2 when n is sufficiently large This was conjectured by Boots and Royle Additionally we identify the outerplanar graph with maximal spectral radius

answering a conjecture of Cvetkovic and Rowlinson Finally we determine the spectral gap of various Cayley graphs of the symmetric group Sn which arise in the context of substring reversals This includes an elementary proof that the prefix reversal or pancake flipping graph has spectral gap one originally proved via representation theory by Cesi We generalize this by showing that a large family of related graphs all have unit spectral gap **Spectral Radius and Signless Laplacian Spectral Radius of K-connected Graphs** Peng Huang,2016 The adjacency matrix of a graph is a 0 1 matrix indexed by the vertex set of the graph And the signless Laplacian matrix of a graph is the sum of its adjacency matrix and its diagonal matrix of vertex degrees The eigenvalues and the signless Laplacian eigenvalues of a graph are the eigenvalues of the adjacency matrix and the signless Laplacian matrix respectively These two matrices of a graph have been studied for several decades since they have been applied to many research field such as computer science communication network information science and so on In this thesis we study k connected graphs and focus on their spectral radius and signless Laplacian spectral radius Firstly we determine the graphs with maximum spectral radius among all k connected graphs of fixed order with given diameter As we know when a graph is regular its spectral radius and signless Laplacian spectral radius can easily be found We obtain an upper bound on the signless Laplacian spectral radius of k connected irregular graphs Finally we give some other results mainly related to the signless Laplacian matrix Regular Graphs Zoran Stanić,2017-04-24 Written for mathematicians working with the theory of graph spectra this primarily theoretical book presents relevant results considering the spectral properties of regular graphs The book begins with a short introduction including necessary terminology and notation The author then proceeds with basic properties specific subclasses of regular graphs like distance regular graphs strongly regular graphs various designs or expanders and determining particular regular graphs Each chapter contains detailed proofs discussions comparisons examples exercises and also indicates possible applications Finally the author also includes some conjectures and open problems to promote further research Contents Spectral properties Particular types of regular graph Determinations of regular graphs Expanders Distance matrix of regular graphs Comparing the Geometric--arithmetic Index and the Spectral Radius of Graphs Mustapha Aouchiche,2016 *A Differential approach to find bounds of the spectral radius of graph under perturbations* Ernest Garriga Valle,1999 *Minimum Spectral Radius of a Weighted Graph* Svatopluk Poljak,Univerzita Karlova. Department of Applied Mathematics,1990 **A Brief Introduction to Spectral Graph Theory** Bogdan Nica,2018 Spectral graph theory starts by associating matrices to graphs notably the adjacency matrix and the Laplacian matrix The general theme is then firstly to compute or estimate the eigenvalues of such matrices and secondly to relate the eigenvalues to structural properties of graphs As it turns out the spectral perspective is a powerful tool Some of its loveliest applications concern facts that are in principle purely graph theoretic or combinatorial This text is an introduction to spectral graph theory but it could also be seen as an invitation to algebraic graph theory The first half is devoted to graphs finite fields and how they come together

This part provides an appealing motivation and context of the second spectral half The text is enriched by many exercises and their solutions The target audience are students from the upper undergraduate level onwards We assume only a familiarity with linear algebra and basic group theory Graph theory finite fields and character theory for abelian groups receive a concise overview and render the text essentially self contained Back cover   <u>Spectral Analysis of Growing Graphs</u> Nobuaki Obata,2017-02-17 This book is designed as a concise introduction to the recent achievements on spectral analysis of graphs or networks from the point of view of quantum or non commutative probability theory The main topics are spectral distributions of the adjacency matrices of finite or infinite graphs and their limit distributions for growing graphs The main vehicle is quantum probability an algebraic extension of the traditional probability theory which provides a new framework for the analysis of adjacency matrices revealing their non commutative nature For example the method of quantum decomposition makes it possible to study spectral distributions by means of interacting Fock spaces or equivalently by orthogonal polynomials Various concepts of independence in quantum probability and corresponding central limit theorems are used for the asymptotic study of spectral distributions for product graphs This book is written for researchers teachers and students interested in graph spectra their asymptotic spectral distributions and various ideas and methods on the basis of quantum probability It is also useful for a quick introduction to quantum probability and for an analytic basis of orthogonal polynomials   **Recent Results in the Theory of Graph Spectra** D.M. Cvetkovic,M. Doob,I. Gutman,A. Torgašev,1988-01-01 The purpose of this volume is to review the results in spectral graph theory which have appeared since 1978 The problem of characterizing graphs with least eigenvalue 2 was one of the original problems of spectral graph theory The techniques used in the investigation of this problem have continued to be useful in other contexts including forbidden subgraph techniques as well as geometric methods involving root systems In the meantime the particular problem giving rise to these methods has been solved almost completely This is indicated in Chapter 1 The study of various combinatorial objects including distance regular and distance transitive graphs association schemes and block designs have made use of eigenvalue techniques usually as a method to show the nonexistence of objects with certain parameters The basic method is to construct a graph which contains the structure of the combinatorial object and then to use the properties of the eigenvalues of the graph Methods of this type are given in Chapter 2 Several topics have been included in Chapter 3 including the relationships between the spectrum and automorphism group of a graph the graph isomorphism and the graph reconstruction problem spectra of random graphs and the Shannon capacity problem Some graph polynomials related to the characteristic polynomial are described in Chapter 4 These include the matching distance and permanental polynomials Applications of the theory of graph spectra to Chemistry and other branches of science are described from a mathematical viewpoint in Chapter 5 The last chapter is devoted to the extension of the theory of graph spectra to infinite graphs

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