Vlsi Physical Design From Graph Partitioning To Timing Closure

Graph PartitioningVLSI Physical Design: From Graph Partitioning to Timing ClosureGraph Partitioning: A Heuristic Procedure to Partition Network GraphsGraph Partitioning and Graph ClusteringGraph Partitioning and Its Applications to Scientific ComputingOn the Complexity of the Graph Partitioning ProblemsGraph Partitioning for Scientific Computing ApplicationsSome Graph Partitioning Problems Related to Program SegmentationMulti-level Spectral K-way Graph PartitioningHigh Quality Graph PartitioningTree-based Graph Partitioning ConstraintAlgorithms for Graph PartitioningGraph Partitioning with EigenvectorsA New Heuristic for the Graph Partitioning ProblemGraph PartitioningLocal Algorithms for Graph Partitioning and Finding Dense SubgraphsAn Empirical Evaluation of Graph Partitioning AlgorithmsSpectral K-way Ratio-cut Graph PartitioningFast Approximate Graph Partitioning AlgorithmsA Graph Partitioning Algorithm by Node Separators Charles-Edmond Bichot Andrew B. Kahng David A. Bader George Karypis Thang Nguyen Bui Irene Moulitsas Brian W. Kernighan Jason Y. Zien Christian Schulz Xavier Lorca James Panek Randal Chang Zhicheng Zhu Reid Andersen Jesús Antonio Izaguirre Jason Y. Zien International Business Machines Corporation. Research Division Joseph W. H. Liu

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graph partitioning is a theoretical subject with applications in many areas principally numerical analysis programs mapping onto parallel architectures image segmentation vlsi design during the last 40 years the literature has strongly increased and big improvements have been made this book brings together the knowledge accumulated during many years to extract both theoretical foundations of graph partitioning and its main applications

the complexity of modern chip design requires extensive use of specialized software throughout the process to achieve the best results a user of this software needs a high level understanding of the underlying mathematical models and algorithms in addition a developer of such software must have a keen understanding of relevant computer science aspects including algorithmic performance bottlenecks and how various algorithms operate and interact this book introduces and compares the fundamental algorithms that are used during the ic physical design phase wherein a geometric chip layout is produced starting from an abstract circuit design this updated second edition includes recent advancements in the state of the art of physical design and builds upon foundational coverage of essential and fundamental techniques numerous examples and tasks with solutions increase the clarity of presentation and facilitate deeper understanding a comprehensive set of slides is available on the internet for each chapter simplifying use of the book in instructional settings this improved second edition of the book will continue to serve the eda and design community well it is a foundational text and reference for the next generation of professionals who will be called on to continue the advancement of our chip design tools and design the most advanced micro electronics dr leon stok vice president electronic design automation ibm systems group this is the book i wish i had when i taught eda in the past and the one i m using from now on dr louis k scheffer howard hughes medical institute i would happily use this book when teaching physical design i know of no other work that s as comprehensive and up to date with algorithmic focus and clear pseudocode for the key algorithms the book is beautifully designed prof john p hayes university of michigan the entire field of electronic design automation owes the authors a great debt for providing a single coherent source on physical design that is clear and tutorial in nature while providing details on key state of the art topics such as timing closure prof kurt keutzer university of california berkeley an excellent balance of the basics and more advanced concepts presented by top experts in the field prof sachin sapatnekar university of minnesota

graphs are mathematical structures used to model pair wise relationship between objects of a certain collection it consists of collection of vertices or nodes and a collection of edges that connect these nodes graphs can be directed from one vertex to another or undirected in our context a graph denotes a network with computers distributed as nodes while the communication channel acting as the edges these are directed graphs where each edge has a capacity which cannot be exceeded in real life applications it becomes very essential that graphs are partitioned in some way so as to satisfy certain conditions for example while placing components of electronic circuit on circuit boards or substrates components that are highly dependent on each other exchanging maximum information should be placed on the same board also an important factor is the number of connections between these boards should be minimized similar situation arises in a computer network where computer systems are distributed over a wide geographic location this is the basis of graph partitioning problem the classical graph partitioning problem consists of dividing a graph into pieces such that the pieces are of about same size and there exists very few connections between these pieces the objective is to partition the nodes of a graph with costs on its edges into subsets so as to minimize the sum of the costs on all edges that are cut let g be graph with n nodes of sizes weights wi 0 i 1 2 n let p be a positive number such that 0

graph partitioning and graph clustering are ubiquitous subtasks in many applications where graphs play an important role generally speaking both techniques aim at the identification of vertex subsets with many internal and few external edges to name only a few problems addressed by graph partitioning and graph clustering algorithms are what are the communities within an online social network how do i speed up a numerical simulation by mapping it efficiently onto a parallel computer how must components be organized on a computer chip such that they can communicate efficiently with each other what are the segments of a digital image which functions are certain genes most likely responsible for the 10th dimacs implementation challenge workshop was devoted to determining realistic performance of algorithms where worst case analysis is overly pessimistic and probabilistic models are too unrealistic articles in the volume describe and analyze various experimental data with the goal of getting insight into realistic algorithm performance in situations where analysis fails

abstract in this paper we consider the problems of removing the smallest weight set of edges or vertices to partition a graph into two disjoint subgraphs of bounded size the complexity of these problems on general graphs is well known to be np hard however the complexity of these problems on planar graphs has remained open for some time we show that the vertex partitioning problem on vertex weighted planar graphs and the edge partitioning problem on edge and vertex weighted planar graphs are np complete we also describe a polynomial time approximation algorithm for the edge partitioning problem which has an approximation factor of o n superscript 2 3 for planar graphs and an approximation factor of o n log n superscript 2 3 for general graphs in particular this approximation algorithm can also handle the case when the partitioned subgraphs are required to be of equal size i e the graph bisection problem this case has not been dealt with until recently and our algorithm has better approximation factor than the algorithm given in 16

the book presents the dissertation high quality graph partitioning of christian schulz

combinatorial problems based on graph partitioning enable us to mathematically represent and model many practical applications mission planning and the routing problems occurring in logistics perfectly illustrate two such examples nevertheless these problems are not based on the same partitioning pattern generally patterns like cycles paths or trees are distinguished moreover the practical applications are often not limited to theoretical problems like the hamiltonian path problem or k node disjoint path problems indeed they usually combine the graph partitioning problem with several restrictions related to the topology of nodes and arcs the diversity of implied constraints in real life applications is a practical limit to the resolution of such problems by approaches considering the partitioning problem independently from each additional restriction this book focuses on constraint satisfaction problems related to tree partitioning problems enriched by several additional constraints that restrict the possible partitions topology on the one hand this title focuses on the structural properties of tree partitioning constraints on the other hand it is dedicated to the interactions between the tree partitioning problem and classical restrictions such as precedence relations or incomparability relations between nodes involved in practical applications precisely tree based graph partitioning constraint shows how to globally take into account several restrictions within one single tree partitioning constraint another interesting aspect of this book is related to the implementation of such a constraint in the context of graph based global constraints the book illustrates how a fully dynamic management of data structures makes the runtime of filtering algorithms independent of the graph density

this thesis is concerned with a new type of approximation algorithm for the fundamental problems of partitioning a graph and identifying its dense subgraphs we develop local approximation algorithms for these two key problems which search for a small set of vertices near a specified seed vertex have a running time that is independent of the size of the graph and for which we can prove a local approximation guarantee

abstract we study graph partitioning problems on graphs with edge capacities and vertex weights the problems of b balanced cuts and k balanced partitions are unified into a new problem called minimum capacity p separators a p separator is a subset of edges whose removal partitions the vertex set into connected components such that the sum of the vertex weights in each component is at most p times the weight of the graph we present a new and simple o log n approximation algorithm for minimum capacity p separators which is based on spreading metrics yielding an o log n approximation algorithm both for b balanced cuts and k balanced partitions in particular this result improves the previous best known approximation factor for k balanced partitions in undirected graphs by a factor of o log k we enhance these results by presenting a version of the algorithm that obtains an o log opt approximation factor the algorithm is based on a technique called spreading metrics that enables us to formulate directly the minimum capacity p separator problem as an integer program we also introduce a generalization called the simultaneous separator problem where the goal is to find a minimum capacity subset of edges that separates a given collection of subsets simultaneously we extend our results to directed graphs for values of p or 1 2 we conclude with an efficient algorithm for computing an optimal spreading metric for p separators this yields more efficient algorithms for computing b balanced cuts than were previously known

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