Guest Editors' Foreword

The current special issue is the indirect result of the **Fourth Workshop on Graph Classes, Optimization, and Width Parameters, GROW 2009**, held in Bergen, Norway, in October 2009. It is a successor to the following special issues of *Discrete Applied Mathematics*: 158-7 (2010) dedicated to GROW 2007, held in Eugene, Oregon; 157-12 (2009) dedicated to the second workshop in the series, held in 2005 in Prague, Czech Republic; 145-2 (2005) dedicated to the first workshop, held in 2001 in Barcelona, Spain; and 54-2/3 (1994) dedicated to a workshop, held in 1989 in Eugene, which in retrospect we view as workshop number zero in what has evolved to become the successful bi-annual GROW workshop series.

This issue comprises 16 papers authored mainly, but not exclusively, by participants of the workshop. All submissions have been carefully refereed and we thank all the referees for their hard work. True to the name of the workshop, the papers in the current special issue report on investigations in three areas of research: **Gr**aph classes, **O**ptimization, and **W**idth parameters. Cognisant of close interconnections among these areas, we introduce the papers in this issue in the corresponding three groups.

The realm of **Graph Classes** is represented by papers describing structural characterizations of different graph classes and exploring their algorithmic properties. *Cicalese and Milanič* introduce the notion of separability of graphs that arises in connection with the parsimony haplotyping problem from computational biology. They provide a characterization of graphs of separability 2 and discuss algorithms on such graphs. *Feder et al.* exhibit a natural forbidden structure characterization for a subclass of interval digraphs, similar to the case of interval graphs. This characterization yields a low-degree polynomial time recognition algorithm for these graphs. The authors strengthen the relevance of this class of digraphs by showing that the list homomorphism problem is solvable in polynomial time on this class. *Gioan and Paul* give structural and incremental characterizations for two non-trivial subclasses of distance hereditary graphs: cographs and 3-leaf powers. Their main tool is the use of bijections between these graph classes and trees whose nodes are labeled by cliques and stars. *Golovach et al.* present a linear-time algorithm for computing the edge search number of cographs, completing the suite of polynomial time algorithms for different variants of graph searching on this class of graphs: node, mixed, and edge searching. In their paper on spanning galaxies, *Gonçalves et al.* discuss the problem of the existence of spanning unions of stars in digraphs. The problem is NP-hard in general. Among positive results the authors show an efficient solution algorithm for strongly connected directed graphs and consider the parameterized version of the general problem.

The **Optimization** section includes papers that study complexity and algorithmic issues of various graph decomposition schemes. Two papers are devoted to distance constrained labeling of graphs, a notion stemming from the Frequency Assignment Problem. *Chudá and Škoviera* use algebraic methods to derive upper bounds for the $L(2,1)$-span of several types of products of graphs: direct, Cartesian, strong, and lexicographic. *Fiala et al.* show that distance three labeling, namely $L(2,1,1)$-labeling, becomes NP-hard already for trees, although it can be computed in polynomial time when lower and upper bounds differ by only 1. *Golovach et al.* study the parameterized complexity of generalized domination (the so called (σ,ρ)-domination introduced by J. A. Telle in the 1990s). *Hagerup* provides a strengthened analysis of an algorithm by Alber et al. that computes a dominating set of size at most k in an n-vertex planar graph. He shows that for $k \leq n/19$, the algorithm runs in time $O(7^k n)$. *van 't Hof et al.* study the computational complexity of induced minors and the closely related question of contractibility of a given graph to the target graph. Among other results they show that this problem is fixed parameter tractable in the order of the target graph if the input belongs to any minor-closed graph class and the target is planar. In their paper on convex colorings of graphs, *Kammer and Tholey* consider the question of recoloring a given colored graph so that all colors induce connected subgraphs. They show that natural variants of this question are NP-hard already for trees and discuss the approximability of this question for graphs of bounded treewidth.

Width Parameters of graphs and other combinatorial structures are a fountain of results and research questions that deepen our insight into the structure of hard combinatorial problems. Variants of width measures are typically related in computational aspects, although some striking differences include the well-known open problem of recognizing graphs of bounded clique-width. In their paper, *Corneil et al.* present the first polynomial time algorithm for recognition of graphs of clique-width at most 3. *Courcelle* studies the complexity of model-checking of monadic second-order formulas with edge set quantification. He shows positive algorithmic results for two new width parameters: clique-width defined for graphs with multiple edges, and a variant of tree-width defined by a rooted structure of the associated tree decomposition. *Heggernes et al.* study another variant of clique-width, the so called linear clique-width, and give a polynomial time recognition algorithm for linear clique-width at most 4. *Knipe* answers a problem of Erlebach et al. by showing that every graph of bounded tree-width can be trimmed, i.e., a small proportion of vertices can be removed to destroy all long simple paths. This was previously known only for graphs with bounded tree-width and bounded maximum degree. Finally *Král'* introduces a new width parameter for matroids, the decomposition width, and shows that every matroid property expressible in the monadic second order logic can be computed in linear time for matroids given by a decomposition with bounded width. This extends similar result of Hliněný who proved the same for matroids of bounded branch-width, with a further necessary condition of representability over a finite field. The new notion of decomposition width removes the need for the latter condition.

The topics discussed in this issue represent an active and vibrant research area of contemporary graph theory. As the issue was coming together, in October 2011, the Fifth Workshop on Graph Classes, Optimization, and Width Parameters, GROW 2011, was held at KAIST in Daejeon, South Korea.

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The participants of GROW 2009 in Bergen City Park