Part IV
Contributions by Martin Grötschel’s
Doctoral Descendants
This book is intended as a present for Martin Grötschel from his doctoral descend- 
dants, many of whom are still active researchers in academic and industry positions. 
When we put out a call for contributions for this book, we issued strict quality 
guidelines and tight deadlines. 
The response has been delightful. The main and final part of this book contains 
these contributions. Every article is coauthored by at least one doctoral descendant. 
They could just as well be articles in optimization journals, except the authors were 
encouraged to relate their work to Martin, and they were free to acknowledge Mar-
tin’s influence. 
The sequence of the articles starts with contributions on the theory of Mathemat-
ical Optimization: Volker Kaibel and Kanstantsin Pashkovich present a framework 
for the construction of extended formulations via projections, with an emphasis 
on reflection relations. Using convex optimization techniques, Michel Baes, Timm 
Oertel, Christian Wagner, and Robert Weismantel reduce the hard core of mixed-
integer convex optimization problems to a certain improvement oracle. Arnaud 
Pêcher and Annegret K. Wagler present superclasses of perfect graphs that still al-
low for the polynomial time computation of the clique number and the chromatic 
number, using the theta number. Zaw Win and Cho Kyi Than introduce the notions 
of the subtree-centroid and subtree-telecenter, and present an efficient algorithm for 
computing a subtree-telecenter of a tree. Carlos E. Ferreira and Alvaro J.P. Franco 
use a characterization of junctions in acyclic graphs to derive efficient algorithms for 
listing target pairs that have a given vertex as a junction. Rafael da Ponte Barbosa 
and Yoshiko Wakabayashi study non-preemptive and preemptive versions of the 
restricted strip cover problem and present both an improved polynomial time ap-
proximation algorithm for the former and an exact polynomial time algorithm for 
the latter. 
The following articles combine new theoretical insights with algorithms and ex-
periments: Ralf Borndörfer, Nam-Düng Hoang, Marika Karbstein, Thorsten Koch, 
and Alexander Martin consider the Steiner connectivity problem and the Steiner 
tree packing problem and present new results concerning complexity, algorithms, 
and computational results. Also in the area of network design, Eduardo Álvare-
Miranda, Ivana Ljubić, and Petra Mutzel consider the maximum weight connected 
subgraph problem; they propose and analyze a new mixed-integer model and out-
perform previous computational experiments on benchmark sets. Frank Baumann, 
Sebastian Berckey and Christoph Buchheim present branch&bound algorithms for 
combinatorial optimization problems with submodular objective functions, alterna-
tively using a linearization technique and Lagrangean decomposition, and put for-
ward experimental evidence of superiority in wireless network design and mean-risk 
optimization. Martin Schmidt, Marc C. Steinbach, and Bernhard M. Willert address 
nonsmooth mixed-integer optimization problems and provide approximate smooth 
reformulations with complementarity constraints, and present numerical results for 
the validation of nominations in gas networks. Björn Geißler, Antonio Morsi, and 
Lars Schewe develop a new algorithm for mixed-integer nonlinear optimization 
based on the adaptive refinement of a new class of mixed-integer linear relaxations 
and demonstrate its potential for gas transport energy cost minimization.
We continue with computational studies: Miguel F. Anjos, Bissan Ghaddar, Lena Hupp, Frauke Liers, and Angelika Wiegele present a computational study of a semidefinite branch&cut approach for the max $k$-cut problem based on the bundle approach that outperforms previous approaches on certain instance classes. Michael N. Jung, Christian Kirches, and Sebastian Sager deal with mixed-integer non-linear optimal control, survey various modeling approaches, and give computational results for a truck cruise control problem with logical implications due to gear constraints. Armin Fügenschuh, George Nemhauser, and Yulian Zeng present a mixed-integer linear optimization formulation of flow-over-flow models driven by the problem of scheduling and routing fly-in safari planes, along with a heuristic based on randomized local search, and present an extensive computational study.

The two closing articles are devoted to computational advances in general mixed-integer linear optimization, the first by scientists working in industry, the second by scientists working in academia: Tobias Achterberg and Roland Wunderling develop an unbiased way to analyze benchmark results and apply it to assess the contributions of the main components in CPLEX 12.5. Thorsten Koch, Alexander Martin, and Marc E. Pfetsch focus on the reproducibility of computational experiments, investigate the performance of competing solvers, and demonstrate the development of the academic solvers SIP and SCIP.

The contributions reflect the “scientific facets” of Martin Grötschel, who has set standards in theory, computation and applications.