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## Preface

When facing complex new optimization problems, it is very natural to use rules of thumb, common sense, trial and error, which are called heuristics, in order to find possible answers. Such approaches are, at first sight, quite different from rigorous scientific approaches, which are usually based on characterizations, deductions, hypotheses and experiments. It is common knowledge that many heuristic criteria and strategies, which are used to find good solutions for particular problems, share common aspects and are often independent of the problems themselves.

In the computer science and artificial intelligence community, the term *metaheuristic* was created and is now well accepted for general techniques which are not specific to a particular problem. Genetic and evolutionary algorithms, tabu search, simulated annealing, iterated local search, ant colony optimization, scatter search, etc. are typical representatives of this generic term. Research in metaheuristics has been very active during the last decades, which is easy to understand, when looking at the wide spectrum of fascinating problems that have been successfully tackled and the beauty of the techniques, many of them inspired by nature. Even though many combinatorial optimization problems are very hard to solve optimally, the quality of the results obtained by somewhat unsophisticated metaheuristics is often impressive.

This success record has motivated researchers to focus on why a given metaheuristic is successful, on which problem instance characteristics should be exploited and on which problem model is best for the metaheuristic of choice. Investigations on theoretical aspects have begun, and formal theories of the working of metaheuristics are being developed. Questions as to which metaheuristic is best for a given problem used to be quite common and, more prosaically, often led to a defensive attitude towards other metaheuristics.

Finally, it also became evident that the concentration on a single metaheuristic is rather restrictive for advancing the state of the art when tackling both academic and practical optimization problems. Examples showed that a skillful combination of metaheuristics with concepts originating from other types of algorithms for optimization can lead to more efficient behavior

and greater flexibility. For example, the incorporation of typical operations research (OR) techniques, such as mathematical programming, into metaheuristics may be beneficial. Also, the combination of metaheuristics with other techniques known from artificial intelligence (AI), such as constraint programming and data mining, can be fruitful. Nowadays, such a combination of one metaheuristic with components from other metaheuristics or with techniques from AI and OR techniques is called a *hybrid metaheuristic*.

The lack of a precise definition of the term hybrid metaheuristics is sometimes subject to criticism. On the contrary, we believe that this relatively open definition is helpful, because strict borderlines between related fields of research often block creative research directions. A vital research community needs new ideas and creativity, not overly strict definitions and limitations.

In 2004, we founded with the First International Workshop on Hybrid Metaheuristics (HM 2004) a series of annual workshops. These workshops have developed into a forum for researchers who direct their work towards hybrid algorithms that go beyond the scope of single metaheuristics. The growing interest in these workshops is an indication that questions regarding the proper integration of different algorithmic components and the adequate analysis of results can now emerge from the shadows. With this backdrop, it becomes evident that hybrid metaheuristics is now a part of experimental science and that its strong interdisciplinarity supports cooperation between researchers with different expertise.

In the light of the above, we feel that it is now time for a textbook on hybrid metaheuristics, presenting the most important achievements and developments in this domain. We have invited key experts in the field to supply chapters with the objective of providing an introduction to the themes of hybrid metaheuristics and discussing associated theoretical aspects or applications. We hope that, by reading this book, either researchers or students will have an easy entry point to this fascinating field and will get a clear overview of its research directions.

Barcelona, Bologna, Brussels  
November 2007

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Hybrid Metaheuristics

An Emerging Approach to Optimization

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2008, X, 290 p., Hardcover

ISBN: 978-3-540-78294-0