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El-Ghazali Talbi (Ed.)

# Hybrid Metaheuristics

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*To my dear wife Keltoum. She always comforts and consoles me. I am such a lucky guy to have found such a wonderful woman.*

*To my two star sons Anis and Chahine. Every time that I saw your smile it lights me up inside.*

*To my daughter Besma, you are my sweet girl with an impressive intelligence.*

*To my mother Zehour for her infinite sacrifice.*

*To my father Ammar who continue to support me in my academic research.*

# **Preface**

## **Importance of This Book**

Applications of optimization is countless. Every process has a potential to be optimized. There is no company which is not involved in solving optimization problems. Indeed, many challenging applications in science and industry can be formulated as optimization problems. Optimization occurs in the minimization of time, cost, risk, or the maximization of profit, quality, efficiency. For instance, there are many possible ways to design a network to optimize the cost and the quality of service; there are many ways to schedule a production to optimize the time; there are many ways to predict a 3D structure of a protein to optimize the potential energy, and so on.

A large number of real-life optimization problems in science, engineering, economics and business are complex and difficult to solve. They cannot be solved in an exact manner within a reasonable amount of time. Using hybrid algorithms is the main alternative to solve this class of problems.

## **Purpose of This Book**

The main goal of this book is to provide a state of the art of hybrid metaheuristics. The book provides a complete background that enables readers to design and implement hybrid metaheuristics to solve complex optimization problems in a diverse range of application domains. Readers learn to solve large scale problems quickly and efficiently. Numerous real-world examples of problems and solutions demonstrate how hybrid metaheuristics are applied in such fields as telecommunication, logistics and transportation, bioinformatics, engineering design, scheduling, etc.

## Audience

One of the main audience of this book is **advanced undergraduate and graduate students** in computer science, operations research, applied mathematics, control, business and management, engineering, etc. Many undergraduate courses on optimization throughout the world would be interested in the contents thanks to the introductory part of the book.

In addition, the **postgraduate** courses related to optimization and complex problem solving will be a direct target of the book. Hybrid metaheuristics are present in more and more postgraduate studies (computer science, business and management, mathematical programming, engineering, control, etc).

The intended audience is also **researchers** in different disciplines. Researchers in computer science and operations research are developing new optimization algorithms. Many researchers in different application domains are also concerned by the use of hybrid metaheuristics to solve their problems.

Many **engineers** are also dealing with optimization in their problem solving. The purpose of the book is to help engineers to use hybrid metaheuristics for solving real-world optimization problems in various domains of application. The application part of the book will deal with many important and strategic domains such as computational biology, telecommunication, engineering design, data mining and machine learning, transportation and logistics, production systems, etc.

## Outline

The book is organized following 17 different chapters organized in 5 parts :

- Unified view of hybrid metaheuristics for mono and multi-objective optimization, and optimization under uncertainty.
- Combining metaheuristics with (complementary) metaheuristics.
- Combining metaheuristics with exact methods from mathematical programming approaches which are mostly used in operations research.
- Combining metaheuristics with constraint programming approaches developed in the artificial intelligence community.
- Combining metaheuristics with machine learning and data mining techniques.

Lille,  
March 2012

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