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## Preface

Calculus has been used in solving many scientific and engineering problems. For optimization problems, however, the differential calculus technique sometimes has a drawback when the objective function is step-wise, discontinuous, or multi-modal, or when decision variables are discrete rather than continuous. Thus, researchers have recently turned their interests into metaheuristic algorithms that have been inspired by natural phenomena such as evolution, animal behavior, or metallic annealing.

This book especially focuses on a music-inspired metaheuristic algorithm, harmony search. Interestingly, there exists an analogy between music and optimization: each musical instrument corresponds to each decision variable; musical note corresponds to variable value; and harmony corresponds to solution vector. Just like musicians in Jazz improvisation play notes randomly or based on experiences in order to find fantastic harmony, variables in the harmony search algorithm have random values or previously-memorized good values in order to find optimal solution.

The recently-developed harmony search algorithm has been vigorously applied to various optimization problems. Thus, the goal of this book is to show readers full spectrum of the algorithm in theory and applications in the form of an edited volume with the following subjects: justification as a metaheuristic algorithm by Yang; literature review by Ingram and Zhang; multi-modal approach by Gao, Wang & Ovaska; computer science applications by Mahdavi; engineering applications by Fesanghary; structural design by Saka; water and environmental applications by Geem, Tseng & Williams; groundwater modeling by Ayvaz; geotechnical analysis by Cheng; energy demand forecasting by Ceylan; sound classification in hearing aids by Alexandre, Cuadra & Gil-Pita; and therapeutic medical physics by Panchal.

As an editor of this book, I'd like to express my deepest thanks to reviewers and proofreaders including Mike Dreis, John Galuardi, Sanghun Kim, Una-May O'Reilly, Byungkyu Park, Ronald Wiles, and Ali Rıza Yıldız, as well as the above-mentioned chapter authors. Furthermore, as a first inventor of the harmony search algorithm, I especially thank Joel Donahue, Chung-Li Tseng, Joong Hoon Kim, and the late G. V. Loganathan (victim of Virginia Tech shooting) for their ideas and support. Finally, I'd like to share the joy of the publication with my family who are unceasing motivators in life.

Zong Woo Geem  
Editor





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Theory and Applications

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