Metaheuristic Applications in Structures and Infrastructures

Description:

Due to an ever-decreasing supply in raw materials and stringent constraints on conventional energy sources, demand for lightweight, efficient and low-cost structures has become crucially important in modern engineering design. This requires engineers to search for optimal and robust design options to address design problems that are commonly large in scale and highly nonlinear, making finding solutions challenging. In the past two decades, metaheuristic algorithms have shown promising power, efficiency and versatility in solving these difficult optimization problems.

This book examines the latest developments of metaheuristics and their applications in structural engineering, construction engineering and earthquake engineering, offering practical case studies as examples to demonstrate real-world applications. Topics cover a range of areas within engineering, including big bang-big crunch approach, genetic algorithms, genetic programming, harmony search, swarm intelligence and some other metaheuristic methods. Case studies include structural identification, vibration analysis and control, topology optimization, transport infrastructure design, design of reinforced concrete, performance-based design of structures and smart pavement management. With its wide range of everyday problems and solutions, Metaheursitic Applications in Structures and Infrastructures can serve as a supplementary text for design courses and computation in engineering as well as a reference for researchers and engineers in metaheuristics, optimization in civil engineering and computational intelligence.

- Review of the latest development of metaheuristics in engineering.
- Detailed algorithm descriptions with focus on practical implementation.
- Uses practical case studies as examples and applications.

Contents:

Mataheuristics in Modelling and Optimization
Traditional and Modern Structural Optimization Techniques
Theory and Application
Metaheuristics and Applications in Structural and Construction Engineering
Particle Swarm Optimization in Civil Infrastructure Systems: State-of-the-art Review and Case Study
Metaheuristics in Structural Design Optimization
Multidisciplinary Design and Optimization Algorithms
Cost Optimization of Column Layout Design of Reinforced Concrete Buildings
Layout Design of Beam-Slab Floors by the Genetic Algorithm
Mathematical and Metaheuristic Applications in Design Optimization of Steel Frames
Optimum Design of Skeletal Structures via Big Bang-Big Crunch Algorithm
Hybrid Formulations of Harmony Search and Big Bang-Big Crunch for Weight Minimization of Truss Structures
Shape Design Optimization using Evolutionary Optimization Algorithms
Graph-based Coding for Truss Topology Optimization
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Evolutionary Path-Dependent Damper Optimization for Variable Building Stiffness Distributions
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Identification of Passive Devices for Vibration Control by Evolutionary Algorithms
Structural Optimization for Frequency Constraints
Optimum Performance-Based Seismic Design of Frames using Meta-Heuristic Optimization Algorithms
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An Evolutionary Divide-and-Conquer Strategy for Structural Identification
Evolutionary Algorithms for Large-Scale Optimization in Construction Management
Network-Level Infrastructure Management based on Meta-Heuristics
Meta-heuristic Algorithms for Large-Scale Maintenance Optimization Problems for Civil Infrastructure Systems
Metaheuristic Applications in Bridge Infrastructure Maintenance Scheduling Considering Stochastic Aspects of Deterioration

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