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2 A Review on Traditional and Modern Structural Optimization: Problems and Techniques

2.1 Optimization Problems; 2.2 Optimization Techniques; 2.3 Optimization History; 2.4 Structural Optimization; 2.4.1 General Concept; 2.4.2 Major Advances in Structural Optimization; 2.4.3 OC Methods; 2.4.4 Reliability-Based Optimization Approach; 2.4.5 Fuzzy Optimization; 2.5 Metaheuristic Optimization Techniques; 2.5.1 Genetic Algorithm; 2.5.2 Simulated Annealing; 2.5.3 Tabu Search; 2.5.4 Ant Colony Optimization; 2.5.5 Particle Swarm Optimization; 2.5.6 Harmony Search; 2.5.7 Big Bang-Big Crunch

2.5.8 Firefly Algorithm

2.5.9 Cuckoo Search; 2.5.10 Other Metaheuristics; References; 3 Particle Swarm Optimization in Civil Infrastructure Systems: State-of-the-Art Review; 3.1 Introduction; 3.2 Particle Swarm Optimization; 3.3 Structural Engineering; 3.3.1 Shape and Size Optimization Problems in Structural Design; 3.3.2 Structural Condition Assessment and Health Monitoring; 3.3.3 Structural Material Characterization and Modeling; 3.3.4 Other PSO Applications in Structural Engineering; 3.4 Transportation and Traffic Engineering; 3.4.1 Transportation Network Design

3.4.2 Traffic Flow Forecasting

3.4.3 Traffic Control; 3.4.4 Traffic Accident Forecasting; 3.4.5 Vehicle Routing Problem; 3.4.6 Other PSO Application in Transportation and Traffic Engineering; 3.5 Hydraulics and Hydrology; 3.5.1 River Stage Prediction; 3.5.2 Design Optimization of Water/Wastewater Distribution Networks; 3.5.3 Reservoir Operation Problems; 3.5.4 Parameter Estimation/Calibration of Hydrological Models; 3.5.5 Other PSO Applications in Hydraulics and Hydrology; 3.6 Construction Engineering; 3.6.1 Construction Planning and Management; 3.6.2 Construction Litigation

3.6.3 Construction Cost Estimation and Prediction

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#### Sommario/riassunto

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 examin

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