

Chapter 1

Introduction and State-of-the-Art Review of Optimum Design of Reinforced Concrete Structures: Overview for Optimum Design RC Structures

ABSTRACT

This first chapter of the book presents an introduction and review study. The necessity of optimization in engineering design is discussed. The nonlinear behavior of problems plays an important role in the usage of metaheuristic methods because of complexity resulting from design constraints considering safety and utilization rules. Design factors in analysis and design of structures are given. A brief history about optimization of structures is presented, including the first early attempts of Galilei Galileo. As the main scope of the book, the review of studies considering optimization of reinforced concrete (RC) structures and members via metaheuristic methods are given. The optimized RC members include beams, columns, slabs, frames, bridges, footings, shear walls, retaining walls, and cylindrical walls.

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THE NECESSITY OF OPTIMIZATION IN ENGINEERING

Several issues must be handled when an engineering design is done. These important issues are about economy, safety, utilization and architecture. To verify a design as an engineered object, the consideration of one or several of these important issues is not enough. An engineering design must consider all these important issues to maintain the needs of individuals. In that case, an engineer has a heavy work to think all issues to find an excellent balance between them. Only experienced ones can handle all issues perfectly. To consider these issues, several measures must be generated, and these issues must be formulated in the design. Since these issues are related to each other, the design problems are generally highly nonlinear, and several methods must be developed, and these methods must be specific to the design problem. Because of non-linearity, these issues can be approximately handled by using conventional methods. Because of increasing demands and advantages of technology, today's needs are beyond an approximate solution. Several non-linearity may be hardly or approximately handled, or a classical solution cannot be found by without assumption of several factors. In that case, the experience may play a great role. For a robust design, the consideration of design stages can be iteratively done by employing an algorithm.

Civil engineering is one of the fundamental engineering disciplines and the products of civil engineers are directly effective on individuals since all reported issues such as economy, safety, utilization and architecture are extremely important in civil engineering designs. Civil engineering has a lot of applications due to all designs providing a living environment fall into the scope of civil engineering. In sub-disciplines of civil engineering such as structural engineering, structural mechanics, structural materials, construction management, geotechnical engineering, transportation engineering and hydraulics, optimization concerns many applications including water resources, superstructure and infrastructure projects, mass transportation and resources, traffic in transportation, stabilization of soil backfills and improvement of the soil.

Civil engineering designs suffers from the environmental conditions and the world has different geographic areas with different resources and differential risks of natural disasters. The most important issue in the design

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