

Preface

The present work derives from the university textbook originally drafted within the cultural tradition of the Structural Engineering School of the Politecnico di Milano. This English edition has been drafted following the publication of two fundamental documents:

- *Eurocode 2—Design of concrete structures*;
- *fib Model Code*,

as better specified in References. The first one represents the last amendment of the final version of the official EN design code collecting the consolidated principles and rules for concrete structures. The second document represents the new edition of the design code issued by the International Federation of Structural Concrete (Fédération Internationale du béton), collecting the latest innovative developments of the research proposed for possible future updating of the official regulations.

With respect to the original edition, the text has therefore been revised and extended, incorporating the most important technological-scientific innovations, which are the basis of the two aforementioned documents, to present a complete set of limit state design criteria of the modern theory of reinforced concrete, saving its educational purposes.

First of all, the completeness typical of a general treatise has been abandoned, incorporating the topics considered of fundamental educational value but leaving out many further developments and alternatives. Specific references are reserved for those.

The intent has been to develop the textbook examining in depth methodological more than notional aspects of the presented topics, and focusing on the verification of assumptions, on the rigorousness of the analysis and on the consequent degree of reliability of results.

The textbook refers to part of the course of structural design and analysis for civil and building engineering students. Form and extent of arguments are mainly driven by teaching needs, as developed throughout the weeks of the academic year.

About its field of competence, the course of structural design and analysis is placed as a logical development after the course of structural mechanics. The fundamental models of structural behaviour are recalled from this discipline, fitting them out with the actual thicknesses due to the real construction materials. The specific properties of these materials and their complex structural arrangement bring up the problem of the reliability of the model: not just one unique solution results, but a domain of possible solutions characterized by different degrees of refinement can be obtained and in any case influenced by the randomness of the input data.

Structural design and analysis is limited to problems of verifications related to simple structures for which the extraction of a model is simple. The wider problem relative to the design choices and the analysis of real complex building arrangements is left to the subsequent specialized courses of the final academic year.

Information for Students and Instructors

The organization of teaching activities has weekly cycles of exercise sessions devoted to numerical applications of the topics already discussed from the theoretical point of view during the lessons. The structure of chapters in this text closely follows this organization. Each chapter develops an organic topic, which is eventually illustrated by examples in each final paragraph containing the relative numerical applications.

The application paragraphs altogether follow an overall plan with the development of the design of principal structural elements in a typical construction ‘from roof, to foundations’. Other than being an opportunity for the application of single topics (e.g. beam in bending, column in compression, foundation footing, etc.), the overall subject shows the first examples of extraction of calculation models from a real structural context and eventually gives the complete building arrangement on which the fundamental verifications of overall stability are to be carried.

Specific appendices are also reported at the end of each chapter, to be used for practical design applications, containing data about materials, formulas for verifications and auxiliary tables, in line with the latest European regulations.

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<http://www.springer.com/978-3-319-52032-2>

Reinforced Concrete Design to Eurocode 2

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2017, XXVII, 836 p. 448 illus., Hardcover

ISBN: 978-3-319-52032-2