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Reinforced Concrete with Worked Examples

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Preface

This volume deals with the design of normal and prestressed reinforced concrete structures in the light of the most recent developments both in the field of concrete and steel materials and in the field of structural modelling. The consolidated part of this evolution has been implemented by the most modern and advanced codes. Eurocode 2 “Design of concrete structures” (EC2), which is under revision, is certainly among these.

The arguments are presented starting from their theoretical approach and then moving on to the regulatory feedback represented by EC2.

The text is accompanied by numerous numerical examples chosen from professional practice. Through this approach, the text will be of interest to both structural engineers and students of engineering and architecture.

The text is developed in 12 chapters, where topics are dealt with according to the same order of EC2. Only Chap. 6, dedicated to prestressed concrete structures, does not have a corresponding section in EC2, where prestressed concrete is considered as a particular case of reinforced concrete and dealt with in various sections of the code.

It will be noted that a lot of space has been given to the most innovative parts such as second-order effects, punching shear and strut-and-tie models.

Eurocode 2, like all other Eurocodes, is applicable in the European Union (EU) countries only if it is accompanied by the “National Annexes”, which must be approved by the competent national authorities. They provide values of national determined parameters (NDP), the choice of which is left to the responsibility of each EU country.

In the text, references to paragraphs and formulas taken from EC2 are indicated in square brackets; for example, [(3.1)] indicates the formula (3.1) of EC2.

Chapters 1, 3, 6, 9, 10 and 12 were authored by Franco Angotti and Maurizio Orlando.

Chapters 2, 4, 5, 7, 8 and 11 were authored by Piero Marro and Matteo Guiglia.

Information for Students and Instructors

The book stands as an ideal learning resource for students of structural design and analysis courses in civil engineering, building construction and architecture, as well as a valuable reference for concrete structural design professionals in practice.

All topics are presented starting from their theoretical bases and passing to corresponding EC2 formulations. The textbook contains twelve chapters, matching the same structure of EC2; only Chap. 6, dealing with prestressed concrete structures, does not match any chapter of EC2, as prestressed concrete is presented in EC2 as a particular case of reinforced concrete, and corresponding formulations are shed over different chapters.

Each chapter presents an organic topic, which is eventually illustrated by worked examples useful for the student who is not familiar with the design of reinforced and prestressed concrete structures by the limit state method. Examples have been chosen among the most frequent cases of the professional practice, so they are also useful for concrete structural design professionals. Moreover, all chapters contain tables, which allow the reader to develop his calculations not only in dimensional form but also in nondimensional form using tabulated values; some tables for punching verification are contained in a specific appendix at the end of Chap. 9.

The appendix at the end of the book provides tables and diagrams for the adimensional calculation at both ULS and SLS of rectangular, T and circular sections subjected to simple bending or to bending combined with axial force.

Florence, Italy
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Structural Eurocodes and Product Standards

In addition to Structural Eurocodes, the following product standards are mentioned in the text:

- EN 206:2021—Concrete. Specification, performance, production and conformity
- EN 197-1:2011—Cement—Composition, specifications and conformity criteria for common cements

Units of Measurement

The following units of measurement were used in the examples:

- *Length*: m, cm, mm
- *Area*: m², cm², mm²
- *Force*: N, kN
- *Stress*: N/mm², MPa
- *Elastic modulus*: N/mm², kN/mm², GPa

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