BOOK REVIEWS


The book is subdivided into four parts: material properties, material modelling, structure modelling and applications to special structures analysis.

The first chapter recalls the mechanical properties of plain and reinforced concrete, of the steels and of the mechanism regarding bond, aggregate interlock and the dowel action. The second chapter (Mathematical Models) tackles the material modelling. The failure criteria, time-independent and time-dependent material models and models describing the interface behaviours (aggregate interlock and bond actions) are exposed, discussed and compared.

Chapter three deals with the structural modelling and places as a premise of all the subsequent developments, the principle of virtual displacements both in the Langrangian and Eulerian form. Through its linear approximation, the solution strategies for the iterative determination of the non linear structural response are introduced. After having recalled the Finite Elements concept by developing the general formulation of the stiffness matrix and of internal and external generalised nodal forces, the Newton iteration technique and the basis of the arch-length method, suitable to handle complex equilibrium paths, are exposed. The subsequent paragraphs tackle, systematically, the stress updating techniques for different material models, the post-peak behaviours, the criteria to detect the concrete failure in crushing and cracking, the presentation of the cracked state (discrete and smeared crack models), the loss of objectivity due to the strain localization effects and the regularization techniques used to avoid them.

The analysis of the time-dependent effects requires discretization with respect to time in addition to the spatial discretization. As regards the time discretization, both algorithms which requires the storage of the complete stress history and those based on Dirichlet series approximation of the creep function are presented and the numerical accuracy of the different time discretization techniques is discussed.

Some detail is paid to the reinforcement representation either by superposition of the material models for the two constituent parts or by considering R.C. as a composite material, continuum on the macrolevel. In the first approach particular attention is given to discrete, embedded and distributed modelling techniques. The tendon representation (tendons, embedded into curved shell and curved beam elements) and the tendon force determination, which takes interaction (friction) losses and time dependent prestress losses into account, are treated in great detail.
In the last chapter, mathematical models and computation techniques are applied to F.E. analysis of R.C. and P.C. structures. This book re-proposes a collection of studies carried out at the Institute for Strength of Materials of the University of Vienna over the last years. The examples, already shown in previous well known papers, regard thick walled three-dimensional R.C. structures, R.C. surface structures, including material and geometric nonlinearities and plate and surface structures including time-dependent effects and accounting for prestress losses.

From a general point of view, the book represents a complete and up-to-date survey of theories and tools which interest the computational mechanics of R.C. and P.C. structures.

All the most important items are preceded by precise introductions, which frame them, each time, into the context of continuum mechanics, of F.E. methodology and of non-linear solution techniques. Similarly, at the end of each mathematical or formal exposition, the characteristics of the several models exposed are discussed and compared and their possibilities and limits underlined and commented on, in order to fulfil the purposes of a specific structural analysis.

The writing is clear and essential. Notations are uniform and coherent all through this work and allow us to easily connect the parts which recall one another.

Mathematical relationships expressing constitutive laws, fitting curves, failure surfaces, etc. are presented in a form which is clear and complete in the numerical values of their coefficients. Appropriate bibliography references are given for particular topics which require a wider or too specific treatment.

As pointed out in the preface, the comprehension of this book assumes the knowledges given by the standard courses of civil engineering curricula at institutions of higher learning (the basic courses on mathematics, mechanics, material sciences, reinforced concrete and finite element method).

This work represents an excellent textbook on computational mechanics of R.C. structures for post-graduate students. For scientists who work in this field it gives a wide and rigorous synthesis of topics which are frequently developed separately and/or in more restricted contexts. For structural engineers, it may be a useful state-of-art report on this matter.

In conclusion, the aim which the Authors proposed to themselves, that is to contribute to a synthesis of constitutive modelling of R.C. and of the structural analysis of R.C. structures and to bridge the gaps between these two constituent parts of the same scientific field, appear brilliantly fulfilled.

P. G. Malerba
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