

# Preface

*Steel Design, Fifth Edition* covers the fundamentals of structural steel design for buildings. This book is intended for junior- and senior-level engineering students, although some of the later chapters can be used in a combination undergraduate/graduate course. Practicing civil engineers who need a review of current practice and the current AISC Specification and Manual will find the book useful as a reference. Students should have a background in mechanics of materials and analysis of statically determinate structures. Knowledge of statically indeterminate structural analysis is not a prerequisite for the use of this book.

Structural design is a complex endeavor, involving the synthesis of many processes. This book does not cover the integrated design of buildings, but presents some of the “building blocks” for structural steel design. We focus on the analysis and design of individual members and connections, rather than complete structures.

Prior to the 2005 Specification and Manual of the American Institute of Steel Construction, load and resistance factor design (LRFD) was covered by the 1999 AISC Specification and *LRFD Manual of Steel Construction, Third Edition*. Allowable stress design (ASD) was covered by the 1978 AISC Specification and *Manual of Steel Construction, Ninth Edition*. In 2005, the two approaches were unified in a single specification and a single manual, the thirteenth edition of the *Steel Construction Manual*. In addition, changes were made to many provisions of the specification, both in form and substance. The unified approach continues with the 2010 Specification and the 14th edition of the *Steel Construction Manual*. Both documents have been revised to reflect current research and practice, but the format remains the same.

Both LRFD and ASD are covered in this textbook, but the emphasis is on LRFD. In most examples, both LRFD and ASD solutions are given. In those examples, the LRFD solution is given first. In some cases, the ASD solution is abbreviated but complete and independent of the LRFD solution. This usually involves some duplication but is necessary if a reader is interested in only the ASD solution. In some ASD solutions where there would be a lengthy duplication, the reader is referred to the LRFD solution for that portion. In some of the examples, particularly in the later chapters, only an LRFD solution is given. This is in keeping with the approach

avored by some instructors; that is, cover both approaches early in the course, then emphasize LRFD as the course progresses. The differences in the two approaches are mostly conceptual, and there is very little difference in the computations. All notation in *Steel Design* is consistent with that in the *Manual*, and AISC equation numbers are used along with sequential numbering of other equations according to the textbook chapter.

U.S. customary units are used throughout, with no introduction of SI units. Although the AISC Specification uses a dual system of units, the steel construction industry is still in a period of transition.

An attempt has been made to strike a balance between the theoretical and the practical. The theory that is presented is within the grasp of undergraduate students, but advanced topics such as plate buckling have been excluded. Analysis and design are initially presented without the aid of tables and graphs from the *Manual*, followed by the introduction of these design aids. These aids are not reproduced in this book, because one objective is to encourage familiarity with the *Manual*. It is therefore essential that students have a copy of the 14th edition of the *Steel Construction Manual*.

All content in this edition has been updated to conform to the newest AISC Specification and *Steel Construction Manual*. This includes the following:

- The new provisions of the Specification and *Manual* are covered in detail.
- A discussion of frame analysis methods has been added. This reflects the increased emphasis on the direct analysis method in the Specification.
- Material on the moment amplification method has been expanded. Additional material on the use of the beam-column tables in the *Manual* is included.
- New material on the shear strength of bolts incorporates the updated strength values given in the Specification. Slip-critical bolt strength has also been modified.
- New material explaining the bolt strength tables has been added. These tables are used in selected examples.
- The example on ultimate strength analysis of eccentric bolted shear connections has been redone, tying it more closely to the tables in the *Manual*. The method used to calculate bolt tension when the load is not in the plane of the connection has been modified to be consistent with the approach used in the *Manual*.
- There is a new emphasis on the use of the lower-bound moment of inertia in computing deflections.
- The material on composite columns has been revised.
- The new approach to proportioning intermediate plate girder stiffeners is included.
- A majority of the problems have been revised.

In keeping with the objective of providing a basic textbook, a large number of assigned problems are given at the end of each chapter. Answers to selected problems are given at the back of the book, and an instructor's manual with solutions, PowerPoint slides of all figures and tables, and Lecture Builder slides of all equations and Example Problems in the book are available through the book website. To access additional course materials, please visit [www.cengagebrain.com](http://www.cengagebrain.com). At the [cengagebrain.com](http://www.cengagebrain.com) home