



CHAPTER 1 Introduction

1.0 Preface

This collection of files is meant to serve as a companion to the textbook *Engineering Mechanics for Structures*, by the same author. As an “electronic” textbook, it generally follows the organization of the “text” textbook but differs in several ways.

It includes micro-simulations of chapter exercises which, in contrast to the fixed format of the printed page, allow the reader to vary one or several parameters and watch the consequences. It includes, too, more sophisticated “tools” for the analysis of structures, a database of material properties in the form of a taxonomy, and other resource data files, e.g., of common structural forms. Finally, there are links  embedded in the text which connect the reader to selected web sites which relate to the design, testing, fabrication, and performance, including failure, of structures.

What the electronic text does *not* have is many pages of text. It is the author’s view that text belongs in a textbook, not on a monitor screen. What text is included is meant primarily to provide a framework for organizing the interactive  exercises, tools, and web links. It should not be taken to be a coherent and comprehensive text for teaching engineering mechanics but rather as a complement to such text textbooks that do exist including, of course, that of the author.

On the other hand, the electronic text does reflect the author’s approach to teaching and, as such, best fits with the latter. For example, included are several *open-ended* exercises meant to promote active learning. These design-type exercises require the student to take more responsibility for the formulation of a problem, for evaluating constraints and specifications, for developing an approach to a solution, and for presenting results. So too a computer simulation allows experimentation,

albeit limited, with the fundamental concepts and principles of engineering mechanics; a matrix analysis tool allows a student to build and model his or her own creation; and a web link encourages independent exploration. More on the aims and content of the textbook follow.

1.1 What's it about.

The text textbook builds upon what you were supposed to learn in your basic physics and mathematics courses. We will recast the basics in our own language, that of engineering mechanics.

For the moment, think of the book as a language text; of yourself as a language student beginning the study of Engineering Mechanics. You must learn the language if you aspire to be an engineer. But this is a difficult language to learn, unlike any other foreign language you have learned. It is difficult because it appears to be a language you already know. That is deceptive: Phrases you have already encountered now take on a more specialized meaning; a *couple of forces* is more than just two forces.

When you become able to speak and respond in a foreign language without thinking of every word, you start to see the world around you from a new perspective. Henceforth, you will look at a tree and see its limbs as cantilever beams (*web*), you will look at a beam and see an internal bending moment, you will look at a bending moment and conjecture a stress distribution. You will also be asked to be creative in the use of this new language — to model, to estimate, to design.

That's the goal: To get you seeing the world from the perspective of an engineer responsible for making sure that the structure does not fail, that the mechanism doesn't make too much noise, that the bridge (*web*) doesn't sway in the wind, that the latch latches firmly, the drive-shaft does not fracture in fatigue... Ultimately, that is what this book is about. Along the way you will learn about stress, strain, the behavior of trusses, beams, of shafts that carry torsion, even columns that may buckle.