專書介紹

Engineering Dynamics Labs with SolidWorks Motion

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1. 工程動力為工學院許多科系的基礎學科。現今分析動力學行為的軟體非常發達，可是所有教科書都沒有充分利用到這種優勢及趨勢。
2. 作者認為現代教科書除了應該著重於名詞、觀念、及公式的誘導外，還應該教導學生使用當代最先進的軟體來進行動力學行為分析，而非訓練學生解題技巧。簡單的手算題還是有必要，但是應僅限於名詞、觀念、及公式的澄清。
3. 本書基本構想是以大學部低年級學生所通用的CAD/CAE軟體為「虛擬實驗室」，配合傳統教科書的章節，設計一系列練習。透過這些練習，一方面可以幫助學生充分理解工程動力學的名詞、觀念、及公式，另一方面也可以教導學生使用當代CAE軟體來分析工程動力學行為的技巧。
4. 選擇SolidWorks為軟體平台是因為它是目前最受歡迎的CAD軟體，歐美大學普遍以此軟體在大學部低年級開授CAD相關課程。SolidWorks Motion為附帶的動力學分析模組，是CAD的自然延伸，學生很容易上手，也不需額外購買費用。
5. 本書將配合軟體的釋出，及時更新版本，使學生能接觸最新軟體功能。
6. 本書是作為標準教科書的輔助教材。
7. 本書著眼於透過動手實作，帶領學生理解工程動力學的名詞、觀念、及公式。
8. 本書是一系列「工程力學實驗」教科書之一。
9. 本書出版社SDC Publications 的主要基地在美國及歐洲，專門出版CAD/CAE教科書。在全世界的CAD/CAE教科書中，市場佔有率相當高。
10. 本書已由全華圖書公司在台灣獨立發行。

Textbook Introduction:

Engineering Dynamics Labs with SolidWorks Motion

By Huei-Huang Lee

Figure 1. illustrates how engineering mechanics curricula are implemented nowadays. Engineering students learn physics and mathematics in their high school years and their first college year. Based on this foundation, the students go further into studying engineering mechanics courses such as Statics, Dynamics, Mechanics of Materials, Heat Transfer, Fluid Mechanics, etc. This paradigm has been practiced for as long as any university professor can remember. I've grown up with this paradigm too. More than 30 years has passed since I graduated from my college, and even the contents of the textbooks remain essentially identical. The only "improvement" is that we have CAD and CAE courses now, as shown in the figure. So, what are the problems of this conventional paradigm of engineering mechanics curricula?

First, conventional curricula relies too much on mathematics to teach the concepts of engineering mechanics. Many students are good at engineering thinking but not good at mathematical thinking. For these students, especially in their junior years, mathematics is an inefficient tool (a nightmare, some would say). As a matter of fact, very few students enjoy mathematics as a tool of learning engineering ideas and concepts. Nowadays, CAE software has matured to a point that it can be used as a tool to learn engineering ideas, concepts, and even formulas. We'll show this through each section of this book. Often, mathematics is not the only way to show engineering concepts, or to explain formulas. Using graphics-based CAE tools is often a better way. It is possible to reduce the dependency on mathematics by a substantial extent.

Second, as shown in the figure, the CAD course is usually taught as a stand-alone subject in a sense that it doesn't serve as part of foundation for engineering mechanics courses. The 3D modeling techniques learned in the CAD course can be a powerful tool. For example, modern CAD software usually allows you to build a mechanism and study the motion of parts. However, our engineering mechanics textbooks haven't illuminated these advantages yet.

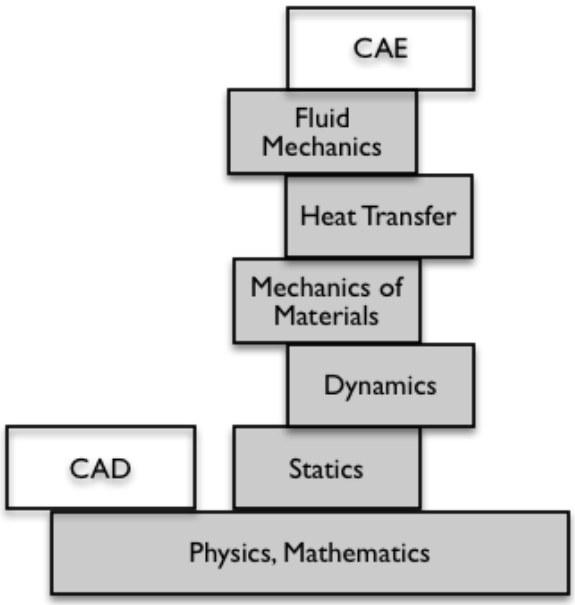

Figure 1. Conventional Paradigm of Engineering Mechanics Curricula

Third, the CAE course is usually taught in the senior or graduate years, because the CAE textbook requires some background knowledge of engineering mechanics. It is my long-term observation that the CAE course should be taught as early as junior years, for the following reasons: (a) If a student begins to learn CAE in his junior years, he will have many years to become proficient at this important engineering skill. (b) After knowing what and how CAE can help him solving problems, a student will be more knowledgeable and confident about what direction he should concentrate on when learning engineering mechanics courses. (c) As mentioned earlier, CAE can be used as a learning tool, just like mathematics, for the ensuing subjects. It'll largely facilitate the learning of engineering mechanics courses.

Figure 2. shows an idea that I'd like to propose for engineering mechanics curricula; this book is developed based on this idea. Engineering students usually learn CAD tools in their junior years. For example, among many CAD tools, SolidWorks has been popularized in many colleges. Naturally SolidWorks might serve as a "virtual laboratory" for the ensuing engineering mechanics courses, such as Statics, Dynamics, Mechanics of Materials, Heat Transfer, Fluid Mechanics, etc.

This book is designed as a software-based lab book to complement a standard textbook in a Engineering Dynamics course, which is usually taught in junior undergraduate years.

There are 11 chapters in this book. Each chapter is designed as one week's workload, consisting of 2 to 3 sections. Each section is designed for a student to follow the exact steps in that section and learn a concept or topic of Mechanics of Materials. Typically, each section takes 30-40 minutes to complete the exercises.

This is a list of the contents:

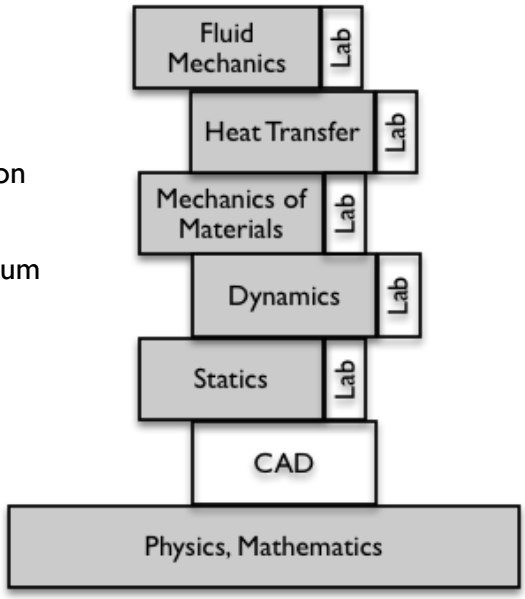

Figure 2. Proposed Paradigm of Engineering Mechanics Curricula