

Guest Editorial

PREFACE TO THE SPECIAL EDITION

AS THE Guest Editor for this special edition of the *International Journal of Engineering Education*, I am pleased to present this compilation of papers that discusses some of the innovations and implementation strategies that are taking place in engineering mechanics education. The majority of the papers presented herein were included in the ‘Workshop on Reform of Undergraduate Mechanics Education’ hosted by the Engineering Science and Mechanics Department at The Pennsylvania State University in State College, Pennsylvania, USA on August 16–18, 1998. A few others have been added because of their relevance to the theme of this special edition.

I have organized the papers into three general categories: applications of computers, integration of design, and curriculum restructuring; however, closer inspection reveals that most of them actually combine two or three of the areas, shown by the overlap regions in Figure 1.

The selection of papers that describe the use of computers in a particular course or courses illustrate just how pervasive the wave of computer technology is. Computers are having an impact on what is taught (analysis tools), how the material is delivered (simulations and multimedia), and how faculty integrate new applications (assessment and tutorials) into the curriculum. In ‘Experiential Learning in Mechanics with Multimedia’ and ‘On the Implementation of Interactive Dynamics’, interactive learning environments are described for fundamental mechanics courses. In the former, Holzer and Andruet address Kolb’s four-stage experiential model with a balance of course activities, including a multimedia learning tool for basic mechanics. In the latter, Costanzo and Gray describe a new interactive dynamics course and emphasize the implementation issues: problem development, course delivery, software selection, team formation, grading, manpower, portability and sustainability. The ‘Use of Computers in Mechanics Education at Ohio State University’ by Staab and Harper discusses the use of commercial software to develop a deeper understanding of complex systems and the use of newly developed tutorials as course supplements. Philpot details his strategy for developing MDSolids—tutorial software for mechanics of materials. As the title of his paper indicates, the software is intended to bridge the gap between typical course features, i.e. lectures and homework. To round out the computer applications section, Negahban describes a computerized version of the Mechanics Readiness Test and how it is used for student evaluation. He reports recent results from the University of Nebraska-Lincoln and compares them to the national results from 1977 and 1987.

The next group of papers uses ‘design’ as the dominant theme. Driven by the desire to provide practice-based components to the fundamental mechanics courses, these authors either incorporate design into existing courses or restructure the curriculum to provide a logical progression of design-based instruction over a sequence of courses. Eronini in ‘Multiple-Feature/Multidisciplinary Design Project in an Introductory Engineering Mechanics Course’ and Salamon and Engel in ‘A Management/Grading System for Teaching Design in Mechanics of Materials and Other Courses’ demonstrate two different approaches to incorporate design into fundamental mechanics courses. Each summarizes modifications to course delivery

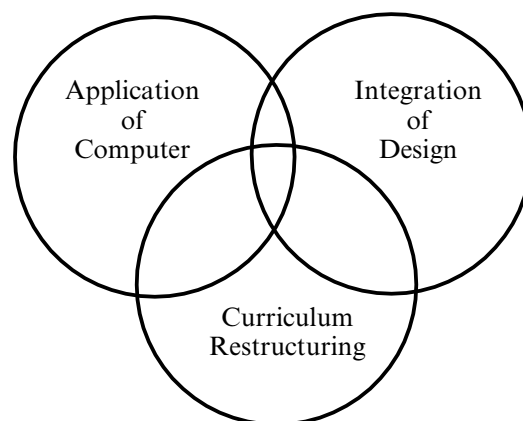


Fig. 1. Scope of trends in engineering mechanics education.

and content; however, the former focuses on the problem description and necessary resources whereas the latter provides a systematic approach to project management and grading. In the last paper in this series, Chang and Fourney describe the restructuring of topics for Statics and Strength of Materials so as to address the broader issues of design as defined by ABET (Accreditation Board for Engineering and Technology). This paper is actually a combination of integrating design and the third general topic area—curriculum restructuring.

Over the past decade, administrators and faculty have been reviewing curricula, seeking ways to maximize the connections between disciplines such as engineering, mathematics and physics. Kraige and Morris detail the approach that the Engineering Science and Mechanics Department at Virginia Polytechnic and State University took to restructure their freshman and sophomore curricula. They discuss the driving force behind the changes and how they integrated the changes into the university system. Cornwell and Fine target the sophomore mechanics sequence at Rose-Hulman to illustrate restructuring along non-traditional lines. Like other Foundation Coalition schools, they repackaged the traditional engineering science curriculum, i.e. mechanics and circuits courses, into courses based on ‘conservation’ and ‘accounting’ principles. Comparisons between student performance in the traditional and modified curricula are presented. Rather than modifications to several courses, the last two papers deal with modifications to single courses. Rubin and Altus describe an alternative approach to a first course dynamics in which the use of indicial notation and tensors lay the groundwork for three-dimensional problems. They outline the course structure and illustrate the approach via two examples: relative motion in two dimensions and three-dimensional motion of a disk driven by dual motors. The final paper in the series deals with the development of a multidisciplinary course in the freshman curriculum at the New Jersey Institute of Technology. Narh and Surjanhata illustrate, by example, how various discipline-specific topics (kinematics, materials, computer tools, graphical representation, and communication skills) are integrated under the umbrella of product-based design projects. The authors describe the tools they use to assess the student reaction to the course and student performance in the course.

In all, this collection of papers reflects current trends in engineering mechanics education. It offers ‘food for thought’ for those considering changes to a single course or curriculum, or the ‘nuts and bolts’ techniques for those embarking on modifications. Whether you find yourself in agreement with the authors’ approaches or you question their educational philosophy, I hope you will find this compilation a valuable resource for your own educational endeavors.

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