

The International Journal of Engineering Education

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- Engineering Education Issues and Research*
- Jeff Jawitz, Jennifer Case and Matseliso Tshabalala** 470–475 Why NOT Engineering? The Process of Career Choice amongst South African Female Students
- This paper seeks to inform current initiatives to attract more women to study engineering. The pool of suitably qualified students at UCT was investigated, and from this group an interviewee sample was drawn of top achievers in school mathematics and physical science who had elected to study courses other than engineering. The interviews yielded information on the process of career choice amongst these students. Findings concerned the universality of medicine as an initial choice, and the current attraction towards commerce. Engineering was only considered by students who ultimately chose B.Sc. degrees, and these were the only students who had a positive experience of school physical science.*
- John D. Gilleard and Jenni Gilleard** 476–482 Creating a Leading Edge: The Link Between Second Language Proficiency, Academic Performance and Employment Leverage for Engineering Students
- This paper considers how a building services engineering department sought to 1) better understand student second-language communication problems, 2) enhance second language proficiency, and 3) adopt skills-based industrial learning approaches to impact both student academic performance and employment leverage. Increasing globalisation has created a need for academia and industry to work more closely together to achieve better language skills among engineers. This study suggests that using specifically focused, subject/departmental-based language assessment strategies, targeting language teaching to performance needs, positively encouraging continuous student motivation, and demonstrably valuing individual language efforts could help engineering students to develop their language skills.*
- Ali Alhemoud** 483–487 A Survey of Kuwait's Demand for Industrial Engineering Graduates
- The program of industrial and systems engineering was recently established in Kuwait. The objective of this study is to predict local market needs for industrial engineers and to determine the extent to which industrial engineering areas are applied in Kuwait's industrial and service sectors. A survey instrument was designed to accomplish this objective and covered five main areas of industrial engineering. The survey was administered in six industrial sectors, namely, oil/chemical and plastic, construction, processed metals and equipment, paper, agricultural and foodstuffs, and the service industry. Content validity of the survey instrument was established by the industrial engineering faculty at Kuwait University. Results revealed that current and future overall demand for industrial engineers is low. The use of multiple linear regression revealed only two areas in which industrial engineers are in high demand. Individual analysis of each local sector was examined to assess the extent to which the industrial engineering discipline applies.*
- Civil and Environmental Engineering*
- Timothy Foutz, Sidney Thompson, Brahm Verma and Alireza Esteghlalian** 488–498 Use of modern design methodologies in natural resource systems
- Many of the engineering students at The University of Georgia (UGA) have a primary interest in natural resource design. While there is an abundance of instructional materials concerning modern design methodologies, this material is concentrated on design of mass-produced products. Thus, the student with an interest in natural resources is not gaining an appreciation of the impact that modern design has on engineering activity. This manuscript describes how the Stepwise Procedure for Incorporating Environmental Consideration into Engineering Solutions (SPIECES) was used to solve this problem.*
- Salah Sadek and Gabriel Houry** 499–508 Soil and Site Improvement Guide: an Educational Tool for Engineered Ground Modification
- The proper selection and evaluation of a soil improvement technique for use at a particular site is neither a simple nor a single-outcome proposition. Local conditions and specificity as well as expertise and judgement, are integral parts in the decision-making process. In an applied engineering educational setting, this process lends itself for treatment using a computer-based design and evaluation approach, relying on a comprehensive database of ground modification techniques and an associated decision-aid tool. This paper describes such an approach, which was developed based on the pertinent codes of practice in the field and expert information and guidelines obtained from various sources. The result is a design and teaching tool which guides the user through the decision-making process, while allowing him/her the opportunity to learn, modify and customize. The proposed guide was specifically developed and implemented by students and faculty in the context of a specialized geotechnical engineering soil improvement course at the American University of Beirut.*
- Computer Studies*
- Ken R. Morison and Patrick J. Jordan** 509–515 Spreadsheet Documentation for Students and Engineers
- Spreadsheets are used widely by engineering professionals and students but a disturbing proportion of spreadsheets has been found to contain errors. An appropriate level of documentation is required for engineering spreadsheets so that others can use, understand, modify, verify and validate them. Methods of documentation and how they can be taught are described. Students, while reluctant at first, learn to document spreadsheets quickly and when working as engineers realise the value of good documentation.*
- Manufacturing Engineering*
- Robert P. Van Til, Sankar Sengupta, Ronald J. Srodawa, Patrick E. Dessert and Christian C. Wagner** 516–523 An Interdisciplinary Laboratory for Teaching Artificial Intelligence and Manufacturing
- The Artificial Intelligence and Manufacturing (AIM) Laboratory is an interdisciplinary facility for engineering and computer science education. The AIM Laboratory was conceived to educate both engineering and computer science students concerning the integration of computer systems in the manufacturing environment. Its facilities are used to conduct both small individual laboratory assignments as well as large team-based projects. These assignments and projects may primarily emphasize either the manufacturing systems or the computer systems as well as focusing on the integration of these systems.*

The distinction between reversible and irreversible compression of an ideal gas in a cylinder with a frictionless piston is analyzed quantitatively. Reversible compression is achieved by moving small masses appropriately distributed vertically onto the piston as it descends and compresses the gas. In the past, this example has been used pedagogically in qualitative form only. Reversibility is demonstrated in several ways, most notably by showing the equality of the work done on the system and the work done by the surroundings.

A thermal engineering laboratory/design project is presented. The objective of the project was to construct an experiment to measure the performance of a heat pump based on first and second law principles. A thermoelectric device drove the heat pump. A student lab group selected, analyzed, designed, planned, built, instrumented, and tested this experiment. The students calculated the coefficient of performance of the system and compared it to the Carnot COP. In addition they calculated a second law efficiency based on entropy generation. The aim of this senior level laboratory project was not only to strengthen their understanding of principles, but also to initiate critical thinking on their own. The experiment was a success, because they applied knowledge from their undergraduate education: thermodynamics, heat transfer, fluid mechanics, electric circuits, instrumentation and design principles.

Control Engineering

This paper deals with the development of a microcontroller-based servomotor position control system for use in undergraduate engineering education. The system was developed to demonstrate a practical method of position sensing, a practical method of actuating the servomotor, and the effects of the use of different control algorithms on closed loop system performance. The work presented in this paper has involved complete design and construction of the microcontroller, the design of the interface with particular emphasis on student use in a laboratory environment, and the design and testing of the different control algorithms. The experimental setup, the processing of the data and the results are presented.

This paper describes a method of integrating various approaches to controller design into a single menu-driven graphical software interface for MATLAB. For convenience sake, the graphical interface is referred to as CADICS (Computer-Aided Design Integration of Control System). The CADICS application package was developed under a Window-based environment to assist engineering students in designing control systems using MATLAB, but who do not have detailed knowledge of MATLAB commands. Two methods of the control system design that are normally taught in engineering undergraduate control courses are incorporated into the program. In the first method (Classical Control), the plant can be compensated by PID, lead or lag compensators. Users choose the type of compensator required and the compensator parameters are automatically determined by the system so as to fulfil the design specification. In the second method (State Space Regulator), control is effected by state feedback, with or without a full-order observer. The paper highlights the program environment and the data storage structure. A case study is described using the developed software (CADICS). The software helps to relieve the load on students to be familiar with MATLAB commands. When used in a laboratory session to illustrate control principles, students will thus have more time to concentrate on the control theory rather than on the design tool, i.e. MATLAB.

Electronic Engineering

Typical undergraduate study programs in digital communication systems (DCS) include a wide range of lecture topics that cover all stages of the system from information source to information sink. However, common practical programs in DCS are aimed more towards helping students to understand theoretical material, rather than providing them with the necessary design experience. In this paper we describe a new approach for giving students hands-on experience in the design of specific parts of a communication system through PC-based projects. The implementation of such a scheme in the existing curriculum is shown to be readily feasible, and its benefits to engineering education are also demonstrated.