Volume 17 Number 6 2001 ISSN 0949-149X

The International Journal of Engineering Education

Contents

A simple laboratory experiment is described, which allows the students to: (i) familiarize themselves with the basics of computer interfacing and data acquisition and (ii), examine the relationship between computer sampling rate, sensor resolution and extracting reliable information from the measured data. It is shown that often data are taken at a rate faster than the pulse train generated by the sensor. This means some adjacent data points can have the same value. Thus, the rate in which the data change, if determined based on these points, is zero even though it is actually not. Least-squares linear regression, using many points, is shown to potentially produce more meaningful information. The experiment has proven to be very effective in providing complementary practical understanding to senior mechanical engineering students enrolled in the 'Automatic Control' course. It will also be incorporated within a 'Mechatronics System Design' course, which is currently under development.

Manufacturing Engineering

Manufacturing Planning and Control (MPC) systems have attracted great interest in recent years. Teaching of this subject however is challenging because of the difficulty of providing appropriate examples in an academic environment. This paper describes a business game developed by a leading automotive components company. The objective of the game is to illustrate the benefits of reducing complexity within manufacturing systems in simplifying planning and control. The paper describes the development process for the game and provides detailed playing instructions. Finally, the paper reviews the use of the game in both an industrial and an academic context.

Recent innovations implemented towards the goal of improved manufacturing education within a small mechanical engineering department are described. The paper discusses evolution of curricular and facility improvements, the program objectives, the constraints bounding the developments, and the effects of completed modifications. Initial efforts targeted the need to incorporate hands-on laboratory experiences within the introductory manufacturing processes course. Subsequent activities have involved curricular adjustments focused on the integration of design and manufacture, and on the associated use of geometric dimensioning and tolerancing practices. Most recent improvements include the development of an elective course in computer aided manufacturing, the impact of an evolving manufacturing research program, and the value of a partnership with the local Small Business Development Center.

Intelligent tutoring systems (ITSs) have potential for making computer-based instruction more adaptive and interactive, but development in the area of manufacturing engineering has been rare. However, recent developments in the area of ITS authoring tools may make this technology more accessible. The objectives of this study were to: 1) evaluate the feasibility of faculty course development using an ITS authoring tool; and 2) evaluate the instructional effectiveness of the developed courseware. An ITS authoring tool called XAIDA was used to develop a tutorial on how to use a computer numerical control (CNC) machine. This paper summarizes the results of a preliminary evaluation conducted with 25 undergraduate manufacturing engineering students. The results suggest that instructional development in XAIDA is feasible and quick, and that students learned from and enjoyed the tutorial.

Information Technology

Effective computer-based educational learning tools must engage the student with significant questions to deepen understanding of the subject. These tools should also provide immediate feedback to the student and, if necessary, direct the student into remedial work. This paper describes the construction of a self-checking interface that can be used to evaluate student answers to challenging questions in an interactive computer-based educational tool. This self-checking interface has been implemented using MATLAB. An example exercise, taken from a computer-based tutorial that uses this self-checking interface, demonstrates how the interface operates.

Chemical Engineering

Freshman engineering students at Rowan University are introduced to engineering design through a series of hands-on engineering and design projects. These design experiences in the first semester are incrementally progressive; their purpose is to lead the students into the second semester and a single, in-depth, reverse engineering project. Previous projects have included the dissection of several inexpensive commercial products such as coffeemakers, toothbrushes, water purifiers, and hairdryers. This paper describes our effort to introduce reverse engineering and design of a process into the course. The focal point is a laboratory project in which students investigate a process for the production of beer. After a brief introduction to the brewing process and a comparative technical evaluation of commercially available beers, the students set out in teams to perform a hands-on, reverse-engineering investigation of the fermentation process and home-brewing equipment. Next, each team plans a commercial venture involving the brewing process. The teams plan their ventures (which may range from a brewery or restaurant to a full-scale brewery and distribution network), and present their designs and a marketing plan to the other groups. The brewing process introduces freshman students to engineering fundamentals related to material balances and stoichiometry, fluid flow, heat and mass transfer, and biochemical reactions. This project, meets several educational objectives: to develop creative and critical thinking, to introduce design principles, to provide hands on experience, to develop teamwork and communication skills, and to stimulate enthusiasm for engineering.

A programme to develop and improve thinking skill in the Unit Operations Laboratory as related to other skills is presented. The programme is divided into three areas: having the right attitude, practicing thinking techniques and tools, and recognising and avoiding thinking errors. It also considers the role of the instructor and the assessment method, emphasises inquiry-oriented and reflective activities, and maintains continuous interaction and immediate feedback from the instructor. The paper includes practical examples on exploring knowledge and experience and on troubleshooting.