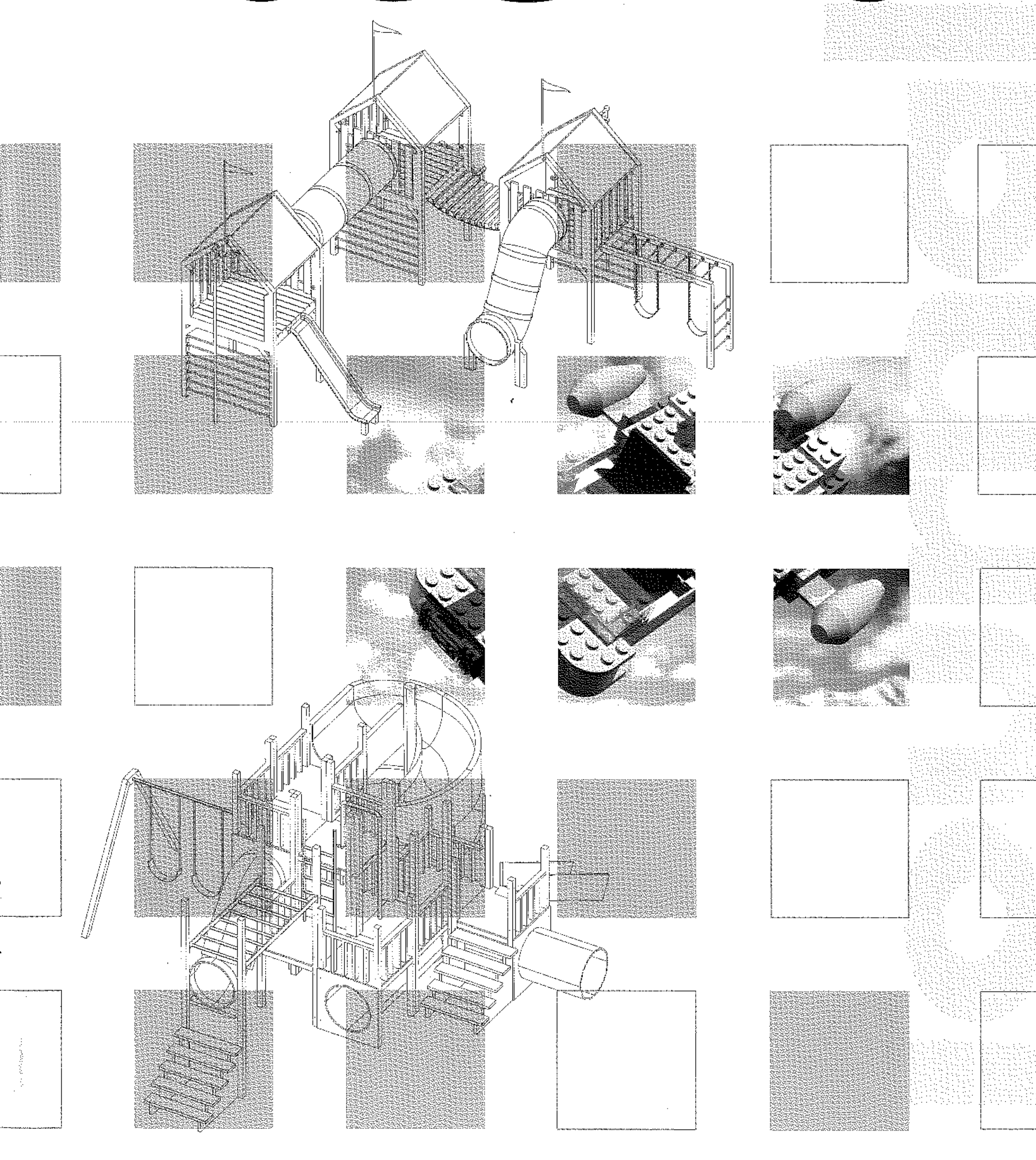
WINTER 2001

volume 65 number 1

THE ENGINEERING DESIGN GRAPHICS Journal



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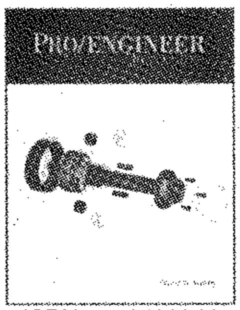

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Technical Graphics Communication, Second Edition with E-text
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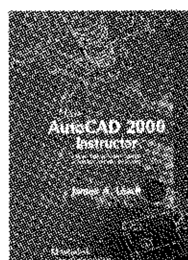

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THE ENGINEERING DESIGN GRAPHICS
Journal

WINTER 2001

volume 65 number 1

The Engineering Design Graphics Journal is the official publication of the Engineering Design Graphics Division of ASEE. The scope of the Journal is devoted to the advancement of engineering design graphics, computer graphics, and subjects related to engineering design graphics in an effort to 1) encourage research, development, and refinement of theory and applications of engineering design graphics for understanding and practice, 2) encourage teachers of engineering design graphics to experiment with and test appropriate teaching techniques and topics to further improve the quality and modernization of instruction and courses, and 3) stimulate the preparation of articles and papers on topics of interest to the membership. Acceptance of submitted papers will depend upon the results of a review process and upon the judgement of the editors as to the importance of the papers to the membership. Papers must be written in a style appropriate for archival purposes.

Cover graphics from articles by Sorby, Hamlin and Buchal.

ISSN 0046-2012

[From the Editor]

Dear Members:

With the rapid changes in technology engineering graphics curricula should respond to these changes. This issue contains articles of the applications of technologies that are of major importance for any engineering graphics curriculum. The utilization of constraint-based solid modeling technology and the downstream applications of solid modeling databases are of central importance for industry. Two interesting articles address the importance of this technology for engineering graphics and compare two major commercial solid modeling packages for educational use. With the widespread utilization of the World Wide Web, CAD and the associated push for collaborative engineering, engineers must understand how to save CAD files so that they can be viewed on the World Wide Web. These issues are also brought to light in one of the articles.

Congratulations are in order for three of the authors of articles presented in this issue of the *Journal*. Douglas Baxter won the Chair's award for his paper titled, *Expanding the Use of Solid Modeling Throughout the Engineering Curriculum.* La Verne Abe Harris and Mary Sadowski paper titled *Alternatives for Saving and Viewing CAD Graphics for the WEB* won the Oppenheimer Award.

Recruiting new members is also vital to the survival of any professional organization. Steve Schroff must be commended for supporting graduate students within the Division. His support allowed two graduate students to attend and present papers at the MidYear meeting in San Antonio. The two recipients were Nancy Study who is working toward a Ph. D. at Purdue University and Nathan Hartman who likewise is working toward a Ph.D. at North Carolina State University. Congratulations!

Susan G. Miller

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Message from the Chair

James Leach
University of Louisville

Business as Usual?

The Engineering Design Graphics Division of ASEE has been active for 73 years now, and we continue to carry on with business as usual. We have long standing traditions focused on conducting meetings, publishing this Journal, and recognizing those who serve the Division and profession. Our organization is structured around these activities and we elect officers who are experienced in the proceedings. However, with such strong traditions, are we positioned to recognize and welcome new people, new technologies, and new ideas in education? Can we, as a Division, evolve with emerging trends and still maintain our traditions centered on engineering graphics education?

My answer to these questions is yes. We do some things very well; however, we could do some things better.

In order to evolve, we must involve more members, especially the capable new members with fresh ideas, in the responsibilities of the Division.

We are doing exactly the right thing by conducting our meetings and publishing issues of the Journal. Through these activities we share ideas and experiences in engineering graphics instruction and research, evaluate them, and incorporate those new applicable and appropriate ideas, experiences, and technologies into our personal, individual teaching. No doubt, we individually gain tremendously from our association with the Division.

We are doing the right thing by recognizing outstanding presentations and thought-provoking papers. In addition to the Oppenheimer Award for presentation, the Division has two relatively new paper awards—the Chair's Award and the Editor's Award. We are introducing promising graduate students to the Division with the recently established Schroff Graduate Student Participation Grant. We have some new membership recruitment initiatives and a new member-mentoring program in place. At the 56th Midyear Meeting in Berkeley, a new keynote speaker/honorary member will address the group with the intent to broaden our vision of graphics and help involve new members. Additionally, a two-year paper session will attract new faces and ideas to the meeting.

Although these activities are good and their mechanisms are set up, the Division utilizes only a small number of its most experienced members to carry out these responsibilities. In order to evolve, we must involve more members, especially the capable new members with fresh ideas, in the responsibilities of the Division.

First, every member (especially you) can share in the most important responsibilities of

Division activities: Carry on liaison with other departments, divisions and professional organizations. Seek out colleagues with related interests and ideas and invite them to associate. Continue to prepare presentations and submit papers for publication, and especially encourage talented colleagues to submit papers to the Journal.

Second, we must involve our able younger members in the structured duties of the Division. In order to effect change, those with new ideas must be in a position to do so. We have many experienced members to act as mentors who can shelter our useful and valued traditions while new possible directions emerge. We need more ways newer members can serve the Division and gain needed positive experience.

Last, we must refocus some of the committees and director positions that are now inactive and strengthen committees that have become more active. It is a travesty for a talented member to serve as a director or committee chair in a capacity that traditionally has no function. Positive experience is gained only from serving a useful position. On the other hand, a few useful positions are not adequately engaged. For example, the Membership Activities Committee (currently a committee of one) holds a tremendous responsibility and has powerful potential to effect positive change in the Division.

Think of ways you can give back to the Division for some of the personal gains you have experienced. Do them. Think about ways we can collectively help the Division grow and evolve in a positive direction. Your ideas are welcome.

Respectfully,

James A. Leach
EDGD Chair

sign up to the engineering design graphics division **listserve**

ASEE Engineering Design Graphics Division Listserve

The unmoderated list generates, on average, two to ten messages per month. Most of the messages are announcements concerning ASEE/EDGD conference information and job openings. Other dialogue is certainly welcome.

In order to properly capture the email address contained in your email header, you should sign up to the list from the email system you most commonly use. Send an email message to:

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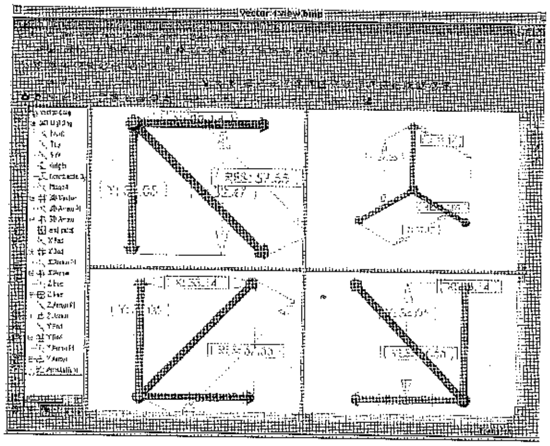

Figure 1 Vector Addition Example

In Figure 1, four views of the vector addition SolidWorks solid model are shown. In the isometric view (top right) the X, Y, and Z vectors are clearly seen with the tip of the resultant vector seen at the intersection of the X, Y, and Z vectors. The three remaining views are the XZ (or top) view (top left), the XY (front) view (bottom left) and the ZY (right) view (bottom right). In each view, it can be seen that the resultant vector as viewed from the principal plane is the vector sum of the two vectors in the viewing plane.

The SolidWorks model was built without any dimensional constraints. The resultant vector was built by creating a three-dimensional line anchored at the origin. A circular cross-section was swept along the three-dimensional line. Finally, an arrow tip was created on the free end of the vector to give the resultant shape the appearance of an arrow. The remaining axial vectors were built as two-dimensional lines starting at the origin and running along a principal axis. The ends of the two-dimensional lines were aligned with the end point of the resultant vector as viewed from the normal plane of the two-dimensional lines. The model tree for the solid model is shown in Figure 2. Note that the features have been labeled so that students can easily identify both the solid portions of the model and the construction geometry (datum planes and curves) used to create the solid model.

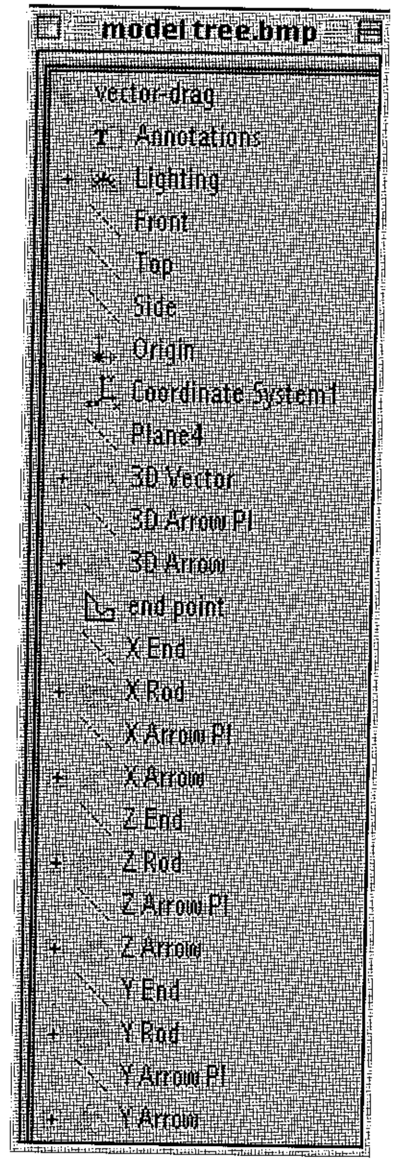

Figure 2 Model Tree for Vector Addition Example

The student can select the resultant vector and then modify the length of the resultant vector by pulling on the end point of the resultant vector. By using a click and drag operation, the student can move the end of the resultant vector. The new length of the vector is shown and the three principal axis vectors are automatically updated and their new lengths are also shown. An example of a modified resultant vector is shown in Figure 3.

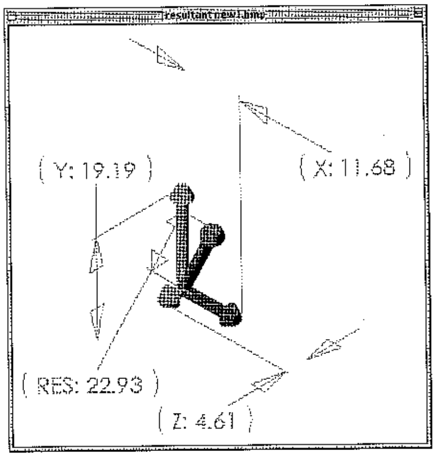

Figure 3 *New Resultant Vector*

Note that the three dimensional view shown in Figure 3 is not an isometric view. One of the advantages of using a solid modeling system is that the student can rotate the solid in any orientation for viewing. The six principal orthographic views and the isometric views are available via icons but any view can be created and then saved if desired. Only minimal knowledge of the solid modeling software is necessary to run this example; the student needs to know how to manipulate the view and how to modify the part size with stretch and drag commands. As these commands are similar to other Windows programs, most students have been able to quickly master these simple commands. Further exploration of the solid model can lead to a better understanding of how to build constrained features and how to use existing geometry in the creation of new geometry within a solid model.

Shape Optimization Example

The second example is taken for a IED homework problem that asks students to maximize the volume of an open ended right cone given a maximum surface area of 200 in^2. Students must document their answer (including references for the equations) and prove that they have found a true maximum. The problem is a simple calculus problem that is easily solved once the formulae for the cone's area and volume are known. Most of the students solve this problem by using the area equation to reduce the volume equation to one variable (either the cone height or cone base diameter), and then differentiate the volume equation twice to solve for the cone height and the cone base diameter and to ensure the solution is a maximum. As the problem is very simple, the goal of this homework assignment is to get the students to practice proper documentation of their analysis and to consider how mathematics is applied to engineering problems. With this example, it is possible to introduce design optimization as a means to solve this problem. To help visualize the problem, a surface model of the cone was created as shown in Figure 4.

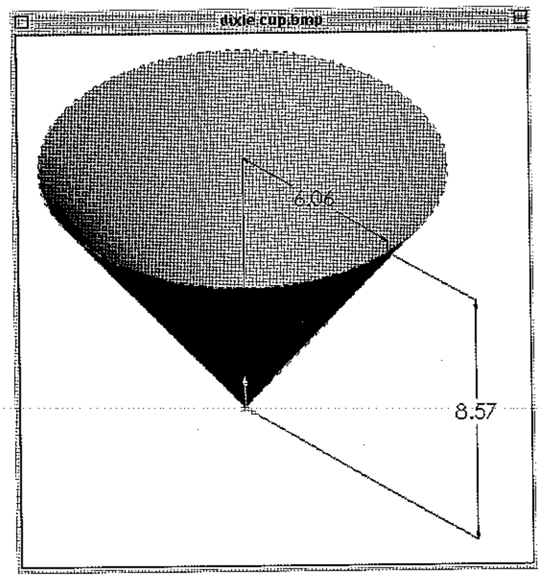

Figure 4 *Surface Model of Open Ended Right Cone*

Students have three software packages that can be used to create a design optimization model to solve this problem. Microsoft Excel was used as Excel's solver is very easy to use. The other two packages (Maple and MatLab) would require writing the subroutines to solve the problem. The Excel spreadsheet is shown in Figure 5. The variables of the problem are the cone base diameter and the height. The surface area and volume cells are formulae taken from Standard Mathematical Tables (1980). The solver window indicates the goal is to maximize the volume (cell B7) by varying the cone height and cone base diameter (cells B4 and B3). A constraint equation states that the surface area (cell B6) is less than or equal to 200 in^2.

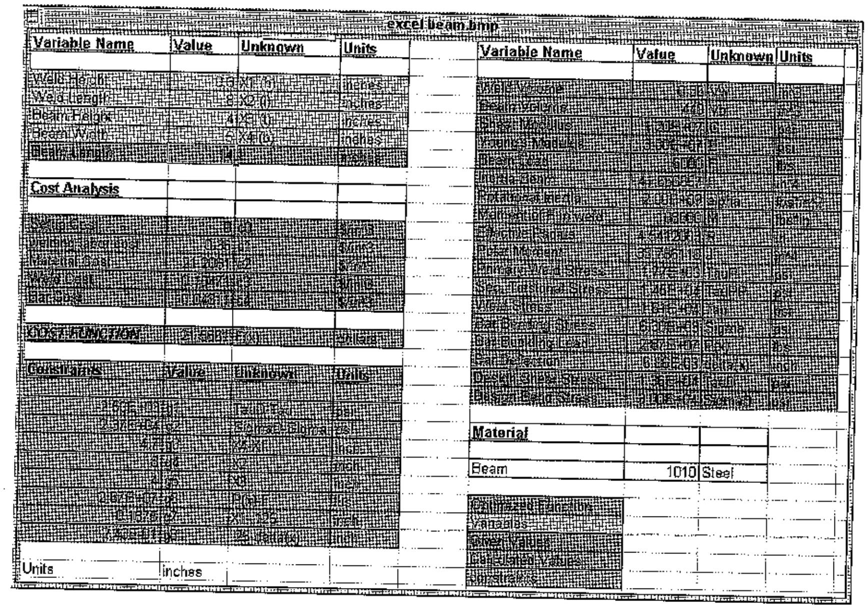

Figure 9 *Excel Spreadsheet for the Welded Beam Example*

The macro for the welded beam example is very similar to the right circular cone example macro in Figure 6. One advantage of using the Microsoft API is that the equations are set up in Excel and the macro just feeds the data back and forth between Excel and SolidWorks. This allows the macros to be stored as templates and retrieved and modified for each example.

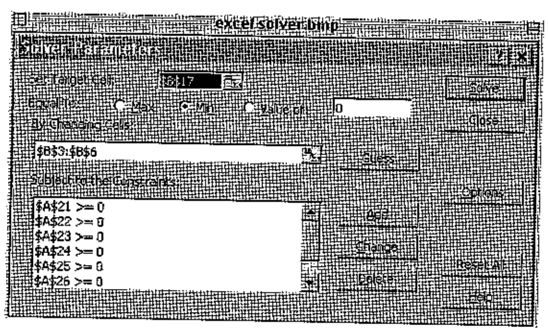

Figure 10
Excel Solver Setup for Welded Beam Example

The advantage of using the macros to visualize the optimization is that students can see how the optimization code behaves. The deflection constraints can be modeled with datum planes displayed in the SolidWorks session. The color of the datum plane can indicate if the constraint is active or inactive. Similarly, the color of the parts can be changed to reflect the status of the other constraints. The final shape f this example is a long slender beam as shov in Figure 11.

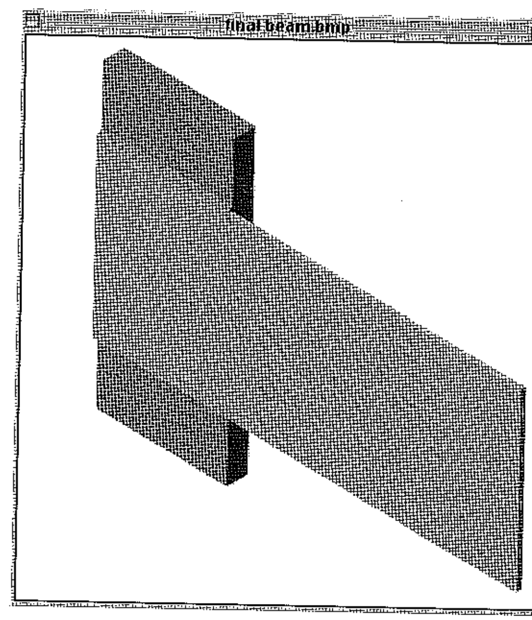

Figure 11 *Final Beam Shape*

Future Work

Future work on these examples is planned The welded beam example could be greatly enhanced by using different solvers Immediate plans are to implement a simulated annealing solver to show how this class o solver differs from a gradient solver. Additional IED homework problems could be modeled and there are plans to add two new homework assignments next semester. Finally, there may be an opportunity to use the solid modeling software in other courses. Structures, dynamics, fluid mechanics, heat transfer and mechatronics should benefit from these types of examples. New software will be needed to make examples for these courses worthwhile.

These examples and the new examples in development will be used in classes over the next year with the hope that a measurable improvement in students' visualization skills can be measured. A visualization quiz has been developed to measure students' progress. Pending the results of the testing, the examples will be incorporated into the courses for which they were developed.

Concluding Remarks

Solid modeling software can be used for more than computer graphics courses and follow on design work. The visualization capabilities coupled with an open API allow for the integration of several engineering packages to demonstrate fundamental principles using the visualization abilities of the solid modeler. Care has been taken to develop models that present these fundamental concepts in a consistent manner with industry practices (Bertoline, et. al., 1997). The models also follow course materials for EG&CAD (Baxter & Bunk, 1999). The examples do not require students to modify the environment on their laptop computers. The goal is to have examples that can be run by students' outside of lecture with minimal instructions. Engineers need to be able to visualize the problems they are trying to formulate and solve. Engineering students also have the need to learn new tools and understand how these tools are applied to engineering problems. By providing the students examples that use the software they will be using in their course work, the students have more exposure to these software packages and thus increase their skills in using these software packages.

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Woolsey, K., Kim, S., & Curtis, G. (1996). VizAbility, PWS Publishing: Boston.

Image. If you use this technique in creating your AutoCAD documents, your images are already pixelated. All you have to do is resize, save in the correct format and resolution, and your image is ready for the Internet. Once again, this image is a 2D representation of your 3D model, so there is no panning and zooming, or 3D orbiting. No markup and measurement tools are accessible, if this image is placed on a Web page.

Alternatives

Some of the following alternatives offer CAD features that Photoshop in itself cannot provide:

SpinFire

Actify's SpinFire Publisher program is a Web-based solution to 3D publishing on the Internet. It delivers design information based from all major CAD systems, including PTC, I-DEAS, Autodesk, Solid Edge, SolidWorks, Unigraphics and Parasolid. You can share designs on the Internet and still protect your proprietary designs. Actify offers a scaleable publish-and-view architecture, which is enhanced for the Internet.

SpinFire Publisher is an application that publishes 3D designs for the Internet supporting all major CAD native formats, including Pro/E, Catia, Unigraphics (Parasolid), Ideas, Autodesk (DWG, DXF and Inventor), SolidWorks, Solid Edge, Parasolid, IGES, STEP, 3D Studio, G-Code, VRML, STL and VDA. This technology creates compressed, direct, view-only publication of all design formats.

The downside is that the SpinFire Publisher costs begin around $5,000 to $25,000 per server, depending in what sort of importers you need (Pro/E, Catia, etc.). The product is relatively new and has only been available for a year.

The SpinFire Viewer, however, is free. It features 3D orbit rotation, zooming, spinning, panning, sketch and markup tool, measurement tool utilizing a grid and ruler, and offers object enabler support. SpinFire Viewer allows the non-CAD viewer the convenience of 3D visualization over the widest range of 3D design formats.

SpinFire Viewer is a lightweight browser plug-in that can be accessed by downloading at: http://www.actify.com. Choose the Explorer browser to download, since the download button is not visible when viewed in the Netscape browser

This free viewer is most impressive. Downloading is fast, the price is right, and it is easy to use. It is really worthwhile to preview the interactive 3D Gallery and Enerpac Catalog at http://www.actify.com/Web/products/SpinFire/showcase.htm. Students will be able to see how it is used as a marketing tool.

For more information go to http://www.actify.com/Web/products/SpinFire/overview.htm.

VoloView Express

Volo View Express is a scaled-down free Internet viewer and printer for DWG, DWF (Drawing Web Format), and DXP files. It is independent of AutoCAD software. A free copy can be downloaded on the Internet in French, Italian, Spanish and German, as well as English at: http://www.autodesk.com /prods/volo/download.htm. The application is also available on CD-ROM. It requires NT 4.0, 95, or 98, and Microsoft Internet Explorer 4 or higher.

Volo View Express features real-time panning and zooming, zooming, and a 3D orbit rotation feature similar to AutoCAD 2000. You can shade 3D models, display AutoCAD 2000 line weights, and also do light markup. The drawback is that there is no measure tool.

A more vigorous version of Volo View Express is simply called "Volo View." This viewer, which is sold for under $200, comes with full-plotting capabilities. VoloView allows designers to share ideas by simply dragging and dropping BWG, DXF, and raster files into the application window. Multiple drawings can be viewed at the same time. Another feature is the ability of the viewer to pan, zoom and do 3D orbit rotation in real time. For the non-CAD user there is the handy feature of measurement tools and markup. Hyperlinks can be added to the drawings as well.

The VoloView online demo can be previewed at http://www3.autodesk.com/adsk/index/0,,224914,00.html#

Autodesk WHIP! Viewer

If you create a DWF files with AutoCAD R14, LT98, 2000 and LT2000, and you have downloaded the free Autodesk WHIP plug-in, you have saved yourself a number of steps. You can launch your Web browser and drag a DWF file into the browser window. You can launch your browser, select OPEN in the File menu, and choose an HTML file that has an embedded DWF file. You can even double-click on a DWF file to launch your browser.

Download the WHIP plug-in by going to http://www.autodesk.com. After downloading, click "grant" and "install" and then restart the browser. A warning appears that it is a test site and may have some bugs. Different releases are available depending on the browser type and computer.

There are a number of options available, such as drag and drop, real-time pan and zoom, layer control, right-click menus, and Microsoft IntelliMouse support. This software has full DWF or HTML output capacity. You can also embed WHIP! Files in Microsoft Office applications. With the URL option of hyperlink display and viewing a specific view using coordinates, the product becomes a clean-looking drawing viewer, but with one big drawback: Autodesk WHIP! does not offer 3D orbit, sketch and markup tool, measuring functionality, and object enabler support. It is simply a viewer. HTML (hypertext markup language) pages on the Web with embedded WHIP files can be viewed once the plug-in is downloaded. Navigation is available, but requires keyboard and mouse activity. Navigate within a drawing by left clicking and dragging your mouse. Switch modes from zoom to pan, by right clicking on your mouse. Select a hyperlink by holding down the shift key and clicking on the link.

CAD Web Product Comparison

Feature	Actify SpinFire Viewer and Publisher	Autodesk Volo View Express	Autodesk WHIP! Viewer
Free viewer download	yes	yes	yes
OPTIONS:			
View DWG	yes	yes	no
View DXF	yes	yes	no
View DWF	yes	yes	yes
3D orbit	yes	yes	no
Sketch and Text Markup tool	yes	yes	no
Measure tool	yes	no	no
Object enabler support	yes	yes	no
Print	yes	yes	yes

This chart compares several free softwares for displaying CAD drawings on the Internet.

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neering design graphics to be:

- developing 3-D visualization skills
- parametric modeling
- 3-D solid modeling
- freehand sketching.

In another survey (Clark & Scales, 1999), the most important future trend identified by respondents was an "increase in 3-D parametric modeling". Several authors have described early efforts to incorporate 3-D CAD into the EDG curriculum (Manner, 1996; Juricic & Barr, 1996; Howell, 1995).

Another trend is the increased integration of design into the first-year curriculum. Many engineering educators are experimenting with the incorporation of design activities into introductory graphics courses (Kallas et al., 1996; Leach & Rajai, 1995).

To make room for these new topics, traditional topics such as descriptive geometry and instrument drawing are being reduced or eliminated. New curriculum models for EDG are being developed (Bertoline, 1993), and excellent textbooks have emerged incorporating some of these changes (Bertoline et al., 1998; Lockhart & Johnson, 2000). Fundamental principles-based courseware for 3-D CAD is still very scarce, but progress is being made to identify and elucidate common themes (Weibe, 1999), and excellent coverage is beginning to appear in textbooks (Lockhart & Johnson, 2000).

Western's Engineering Graphics Course

At UWO, approximately 250 freshman engineering students take a common Engineering Graphics course over a 13-week semester. This course introduces students to the engineering design process, and the principles of graphics and 3-D modeling in the creation, visualization, communication, processing and documentation of engineering designs. Sketching and CAD are used to create multiview and pictorial drawings, auxiliary and section views. Students are introduced to parametric 3-D part modeling, assembly modeling, rendering, and production of working drawings from CAD models. Other topics inc
sioning and tolerancing, projectio
drawing standards.

In 1998-99, this course was
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to supplement 2-D CAD using A
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assignments, an AutoCAD practi
class quizzes, and a final written

Parametric Modeling and Solid E

Solid Edge from Unigraphics Sol
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used in industry. Conceptually it
lar to other modelers, including
Mechanical Desktop, SDRC
Pro/Engineer and others. Soli
Windows-native midrange pac
much easier to learn and use th
packages like I-DEAS, withou
much functionality.

It is worth noting here that there
fusion and inconsistency about
this "solid modeling" software.
"parametric", "constraint-base
based" are used interchangeably
tively. Further, most of these sys
pass assembly modeling as well.
this class of software offers the fo
bilities: feature-based parametri
ing, assembly modeling, associa
production, and rendering.

Project Descriptio

A team-based design project was
take students through all stages
rent engineering design process
and engaging way. Each team w
design an innovative and ima
toy. More specifically, the teams

to define the problem, generate and sketch alternative design ideas, select the best design, generate a detailed design model in Solid Edge, and produce design documentation in the form of Solid Edge working drawings and renderings.

The use of Lego offered several advantages. Lego kits are widely available at low cost, the Lego pieces are well suited to the capabilities of feature-based modelers, and the pieces snap together in a standard way to create assemblies. Only standard Lego pieces were modeled ñ the creativity lay in selecting pieces to use, and assembling them in interesting ways.

Learning Objectives and Pedagogy

Focusing on Fundamentals

The emphasis was on having students learn the fundamental concepts of parametric solid modeling, rather than the detailed use of a particular software package. It is clear that there are fundamental concepts shared by all leading solid modeling packages, and that differences are mostly in terminology and user interfaces.

Unfortunately, most currently available CAD training material focuses on learning specific packages rather than emphasizing fundamentals. For example, some AutoCAD manuals devote a full chapter to various ways of constructing lines, and in the process completely obscure the basic principles of defining lines. On the other hand, general CAD and graphics textbooks tend to be out of date, with little or no coverage of solid modeling principles. So far, only Engineering Design Communication by Lockhart and Johnson (2000) contains good generic coverage of modern parametric modeling.

In addition to lectures and textbook material (Bertoline et al., 1998) on the design process and general engineering graphics, this course relied on a set of generic PowerPoint lectures developed by the author to cover the basic principles of solid modeling. A total of about six lectures were devoted to the topics described below.

1. 3-D Modeling and the Design Process
Types of models and representations used in engineering; types of modeling systems (2-D, wireframe, surface and solid modelers); comparison of design using 2-D versus 3-D CAD.

2. Solid Modeling
History and types of 3-D CAD systems; principles of feature-based modeling; the modeling process (sketch profiles and extend into 3-D); generic tools for creating features (protrusions, cutouts, sweeps, lofts, revolutions, treatments); feature history trees; modifying geometry.

3. Constraint-based (Parametric) Modeling
Design intent; constraint types (ground, geometric, dimensional); smart sketching tools (automatic application of constraints during sketching).

4. Assembly Modeling
Definition, applications and examples; assembly hierarchy (assembly trees); assembly constraints or relations; mechanism modeling.

5. Generating Drawings from 3-D Models
Associativity between models and drawings; defining drawing standards; laying out views (principal, section, auxiliary, details); adding dimensions and notes.

6. Rendering and Visualization
Lighting; shading; material appearance; texture mapping; shadows and reflections; antialiasing; ray tracing; animations; VRML.

Self-directed, Project-based Learning

No lecture or lab time was devoted to formal Solid Edge training. Principles and methods were demonstrated in the lecture, but students were not expected to remember or repeat the detailed steps. Students were urged to learn the basic operation of Solid Edge by following the excellent on-line tutorials on their own. Only three 3-hour lab sessions were scheduled for Solid Edge, so students were expected to

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Table 1

printed or "submitted". All course marks were recorded in a shared Excel spreadsheet located in a secure, shared network directory. This allowed instructors and authorized teaching assistants to enter marks directly without producing redundant or inconsistent records.

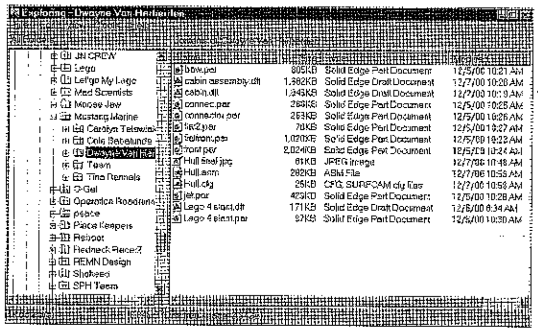

Figure 1 *Opening and viewing student files on a shared network drive*

This process worked relatively well, although sometimes it was difficult to determine which files to open for evaluation. Most problems occurred when students failed to save files to the correct locations. For 250 students in 62 teams, the total disk space usage reached about 1.5Gb by the end of the term.

Other Issues and Lessons

Experience with this project exposed several issues that need to be addressed in future iterations. Generally, problems and issues were minor, and could be overcome with proper planning.

Instructor and TA Software Knowledge

Since each project was unique, students came across difficult modeling problems that were not well documented and were often beyond the expertise of the instructor and teaching assistants. In particular, the TAs had little or no solid modeling background, and were unable to provide much detailed help. However, once students realized someone would not just show them how to do the modeling, they spent more time with the tutorials and on-line help to learn for themselves.

An advantage of using Lego is that the same pieces and modeling issues come up again and again. This makes it easier to create a
base of specific tips and techniques to us

Software Glitches and Limitations

Contrary to marketing claims, every
package has bugs, poorly document
implemented features, and limitations.
are normally discovered through use c
software, and work-a-rounds must be f
Many of the modeling problems encour
were due to limitations of the software
As these problems were encountered, tip
procedures were posted on the website.

Often these glitches and limitations disa
in the next release of the software. Pro
like Solid Edge are evolving very rapidly
major new releases every six months or s

Simplistic Modeling Approach

Solid modeling packages provide many r
ods and tools for part modeling. Due to la
time, students would typically discover o
two tools and techniques, and create e
thing with them. Hence, students cr
complex parts using nothing but protru
and cutouts. Powerful tools like feature
terns, mirroring, etc. remained undisco
and unused. More time needs to be spe
really understand and explore the mod
techniques that are available.

Confusion about Deliverables

Students tend to be uncomfortable with c
ended assignments, and want to know ex
what is required. During the first offeri
the project, there was confusion about
expected deliverables, and hence the re
were highly variable. It cannot be assu
that students understand what is expe
when they are asked for a multiview dra
or a rendering. During the second offe
much more explicit instructions, exam
and evaluation criteria were posted on
website. Student renderings from the
project were also posted to serve as exam
and motivation. There were far fewer q
tions from students during the second pro
but as always there were a few who chose
to follow the instructions.

File Sharing Problems

Solid Edge is designed to simplify sharing of files on a Windows network. In particular, assembly models contain links to the network paths of the included part model files. Problems arose when students worked on parts and assemblies at home, then copied the files to the network drive. In many cases, links in the assembly models were broken when part model files were not in the expected locations. Another major problem was students saving model files in their personal network directories, not realizing that no one else would be able to access them. These problems could be overcome with a better understanding of Solid Edge's file management capabilities and limitations.

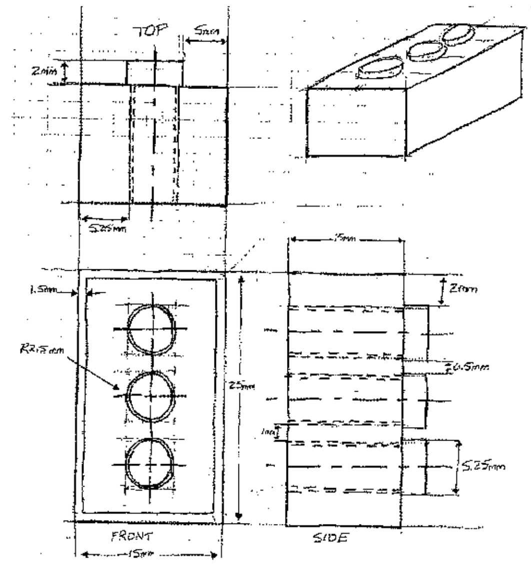

Figure 2 *Multiview sketch of a part*

Results and Samples

Each team was required to submit a set of design sketches showing preliminary ideas. These sketches included multiview drawings, pictorial drawings, assemblies, section views, etc. as required. Each student was required to submit multiview and pictorial sketches of an individual part. Following this, the students individually created the solid models of the individual parts using Solid Edge. The team came back together to assemble the part models, render a pictorial view of the assembly, and create a set of working drawings.

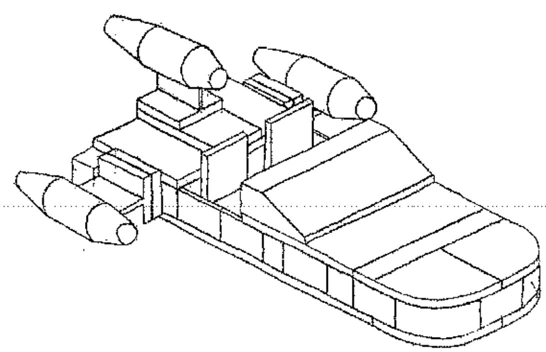

Figure 3 *Freehand isometric sketch of a design concept*

Figure 2 shows a sample sketch of a part, of average quality. Figure 3 shows an above average sketch of a preliminary design idea. Figure 4 shows a Solid Edge part model of typical complexity. Note that only six feature operations were required to model this part. Figure 5 shows a typical exploded assembly drawing, and Figure 6 shows a typical detail drawing. Figure 7 and Figure 8 show renderings of two designs of typical complexity.

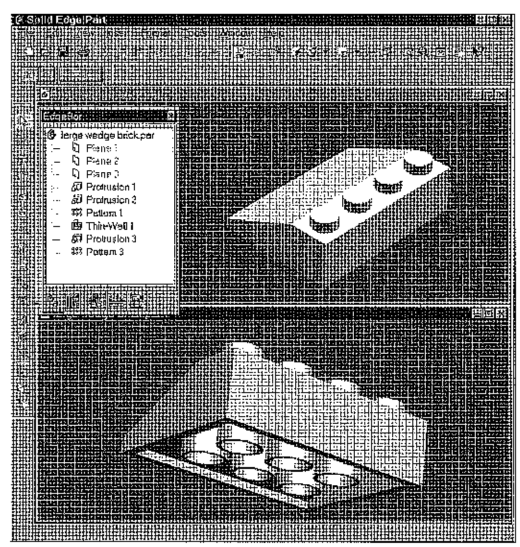

Figure 4 *Sample part model of typical complexity*

Student Feedback

After the first offering of the project in the September 1999 semester, an on-line survey was used to collect student feedback. A total of 61 responses were submitted, representing about 25% of the enrolled students. Selected results are presented in the following sections.

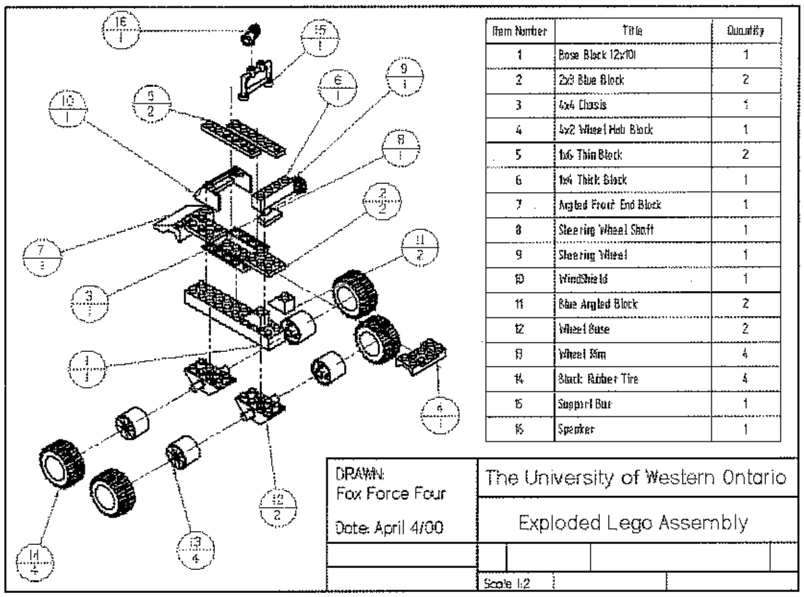

Figure 5 *Exploded assembly drawing of a final design*

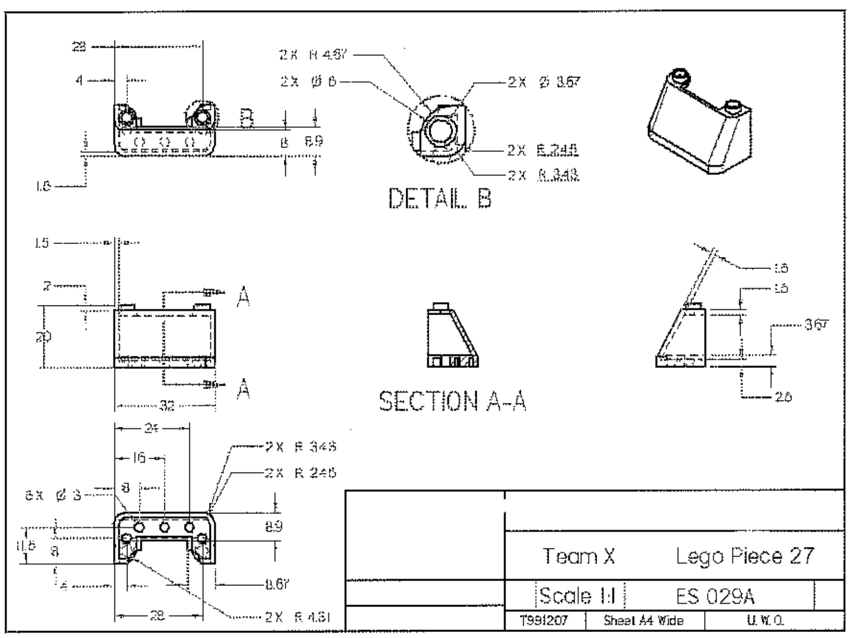

Figure 6 *Detail drawing of a part*

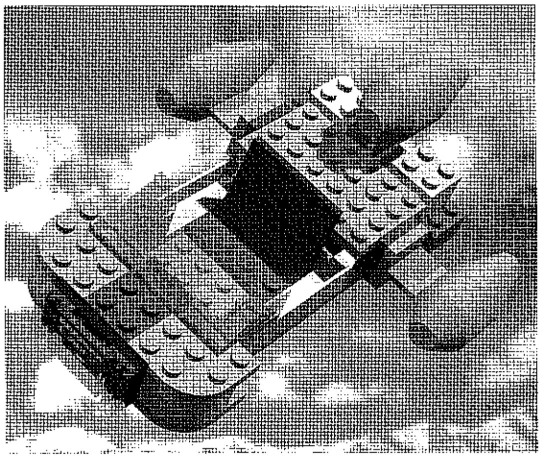

Figure 7 Rendered image of a typical final design

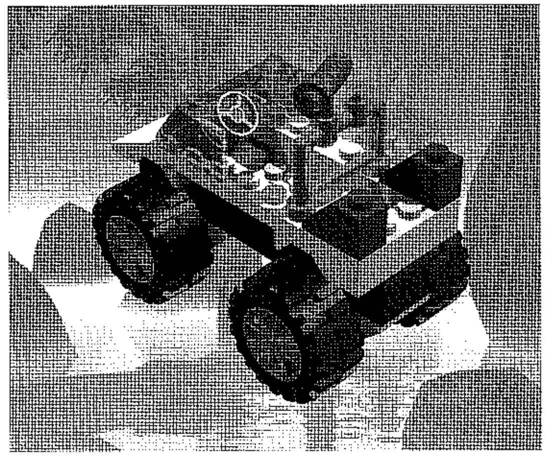

Figure 8 Another typical rendered design

Interest and Perceived Relevance

As indicated in Figure 9 and Figure 10, students found the CAD software to be the most interesting part of the course, as well as the most relevant. Students also recognize the value of sketching skills. Overall, student perceptions of important topics correspond well with surveys of EDG educators.

Interestingly, students consider AutoCAD to be highly relevant despite our efforts to convey the advantages of parametric solid modeling. This is probably a reflection of AutoCAD's current dominance in the industry, and students see AutoCAD experience as a requirement for getting a job. Also, many of these students are heading into electrical, chemical and civil engineering, where 3-D modeling is either inappropriate or immature.

Self-directed Learning

The author initially estimated students would spend 20 to 30 hours to complete the project, including learning the software. The survey results (Figure 11) show this was about right. Some students spent much more or much less time than average, and this probably corresponds to the range of resulting project quality.

While there was a range of responses, students generally rated Solid Edge above average in ease of use and quality of on-line tutorials. Generally, students who put the time and effort into doing the tutorials gained enough knowledge to complete the project. Some particularly ambitious students discovered the limitations of Solid Edge and its documentation when attempting more advanced tasks.

Course Website

The course website was the main vehicle for communicating project requirements and other information to students. The website was updated and enhanced frequently as necessary. Students rated the course website as good to excellent.

Educational Objectives

Student perceptions of achievement of educational objectives were assessed by responses to the following three survey questions:

- "Overall, how was your experience working on a team on this project?"
- "How well did this project develop your overall appreciation of the design process and the use of 3-D CAD?"
- "What is your overall assessment of the educational value of this project?"

As summarized in Figure 12, student response to working in teams was positive, students perceived the educational value of the project to be high, and that they felt the learning objectives were successfully achieved.

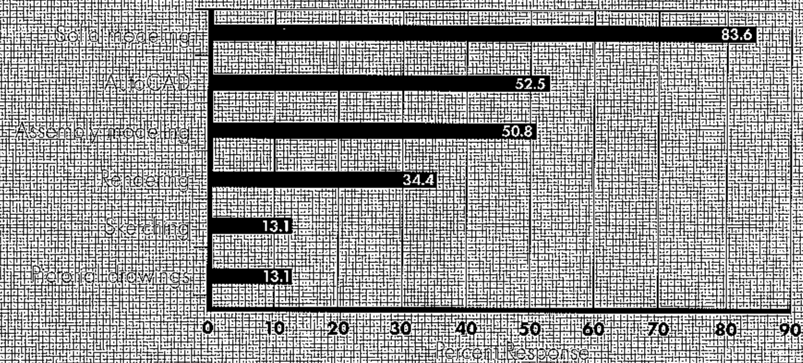

Figure 9

Top six responses to the question "Which three of the following topics did you find the most interesting?"

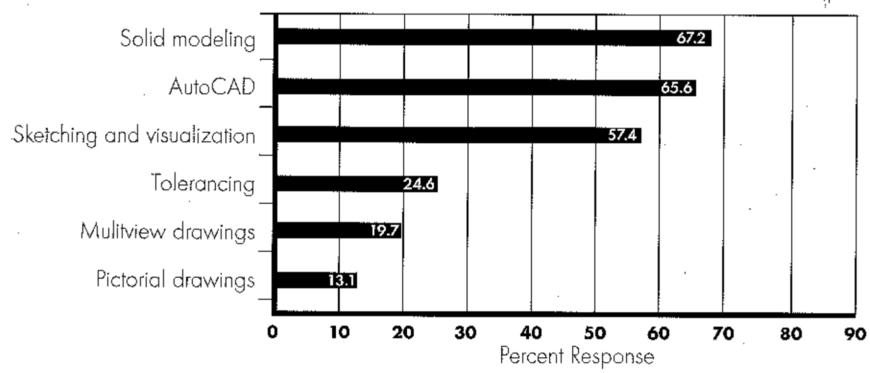

Figure 10

Top six responses to the question "Which three of the following topics do you think are the most important or relevant?"

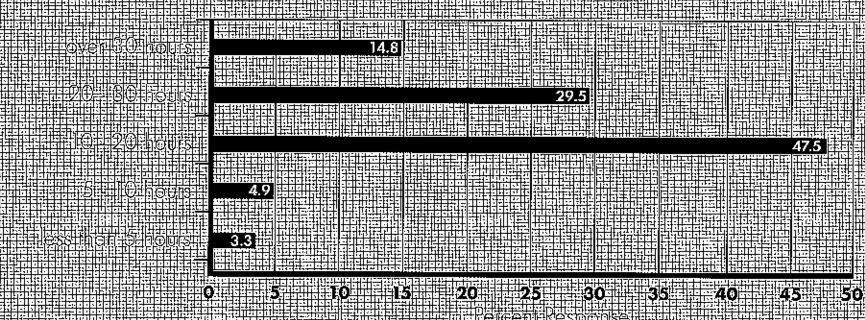

Figure 11

Response to the question "How many hours did you spend on the Solid Edge part of the project?"

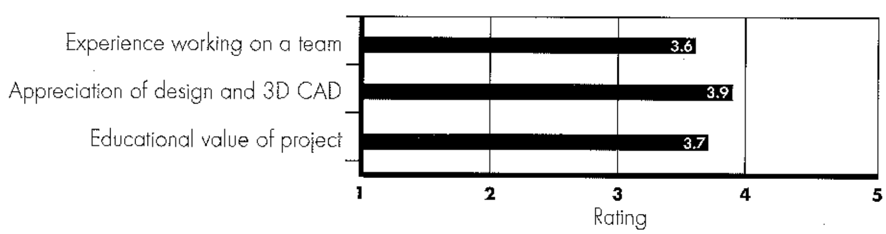

Figure 12

Mean survey results for questions relating to educational objectives.
Ratings were on a scale of 1 (poor) to 5 (excellent), with 3 being neutral.

Conclusions

While this is by no means a controlled research study, several useful conclusions can be drawn nonetheless. Our experience supports the following conclusions:

- Freshman engineering students are capable of completing a fairly complex solid modeling project in as little as 20 hours. This makes it possible to incorporate such projects even as a minor component of a one-semester course.
- Current solid modelers like Solid Edge are sufficiently easy to use that students require little or no formal instruction. Students can learn the basics of the software themselves in just a few hours.
- Unique team-based projects are feasible and manageable even for large class sizes, as long as general guidelines and specific deliverables are clear.
- Generic courseware and textbooks are required to cover the basic concepts of parametric modeling. Experience suggests that simply using the software does not lead to an appreciation of generic concepts, and that most software training focuses too much on detailed software operation without sufficiently exposing these concepts.
- Student response to team-based design and modeling projects was very positive, with most feeling that it was an excellent learning experience. This supports the view that team-based design projects improve motivation and engagement in achieving the learning objectives.

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A Comparison of Two Commercial Constraint-Based Modelers for Use in an Engineering Graphics Course

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Abstract

With the increasing popularity of constraint-based modeling software, the question we graphics educators must now answer has shifted from "Why?" to "Which package?" As educators, we often struggle to walk the fine line between doing what is best for our students and doing what industry wants us to do. This is particularly true when it comes to the selection of the specific software packages we use in our courses. Local or regional industries may exert pressure directly or indirectly through their hiring practices to convince us to use the same software packages that they use. In this way they can reduce their need to pay for training for the engineers or technologists that they hire. This paper will examine student perceptions in learning two different commercially available constraint-based modelers. Personal observations of the authors in teaching these two software packages will also be included in the paper.

Background

In 1990, an NSF-sponsored symposium was held in Austin, Texas on the modernization of the Engineering Design Graphics (EDG) curriculum (Barr & Juricic, 1990a). This symposium stemmed largely from the work of Barr and Juricic who had been awarded an NSF grant to develop a "modern" model EDG curriculum (Barr & Juricic, 1990b). The result of this curriculum modernization project was to recommend that graphics instruction begin with 3-D modeling and end with 2-D drawing standards and conventions. Recently, with the development of 3-D constraint-based modelers, this new technology is viewed as the basis for EDG instruction (Ault, 1999). Wiebe (1999) compared four different constraint-based modelers currently in use in graphics education and found that there are many "common themes" among the software packages.

American industry is embracing constraint-based modeling on a widespread basis (Halliday, 1996, Kensinger, 1996, Beckert, 1996). For example, Ford Inc. worldwide (Mills, 1996) and XEROX recently adopted I-DEAS software as their design and analysis standard. Pro/E has been adopted as the design standard for other midwest companies such as Mercury Marine, Caterpillar, and Harley Davidson. AutoCAD has always had and continues to have a strong following in the engineering community, especially for smaller companies. This has greatly increased the demand for engineers who are well-versed in constraint-based modeling techniques not only for these companies but also at all of the suppliers who work with the companies in the design and manufacture of engineering systems.

At Michigan Tech we have a long history of using SDRC's I-DEAS software for senior-level courses in Mechanical Engineering and for a freshman-level CAD course in the General Engineering Department. For our freshman Mechanical Engineering graphics courses, we used CADKEY for many years and have recently switched to Pro/E. During the 1998-99 academic year, the authors of this paper taught two introductory graphics courses for Mechanical Engineering students. In the first term, the students were taught to use Pro/E and in the second term they were taught to use I-DEAS. At the end of the two course

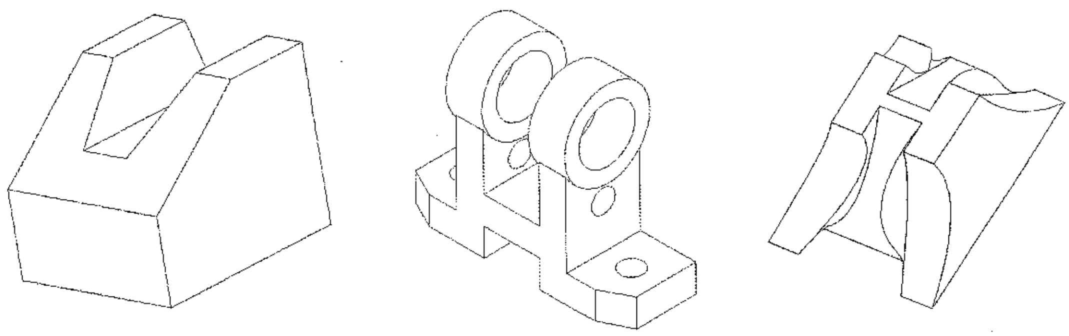

Figure 1 *Sample Pro/E Assignments from ME104*

sequence, the students were given a questionnaire comparing the two packages from a "learners" point of view.

Methodology

First-year Mechanical Engineering students at Michigan Tech enroll in two introductory graphics courses. This first course, ME104, stresses sketching, orthographic projection, pictorial sketching, sections and various other more or less "traditional" graphics topics. Very little instrument drawing is included in the course. In addition, students are introduced to constraint-based modeling through the use of Pro/E software. The students complete four fairly rudimentary Pro/E assignments designed to introduce the concept of constraint-based modeling in general and the workings of Pro/E specifically. Sample Pro/E assignments from ME104 are shown in Figure 1. During the 1998-99 academic year, nearly all of the sections of ME104 were taught by one of the authors of this paper (Hamlin) who was himself a new Pro/E user. The course met for three one-hour sessions per week for a total of 30 hours (Michigan Tech is currently on the quarter system). Approximately four sessions were devoted to in-class demonstrations of the workings of Pro/E and students were required to complete their Pro/E assignments on their own after hours. Student Assistants were available in the computer labs during specified hours to assist ME104 students with the workings of Pro/E in the completion of their assignments as needed.

Most students who learned Pro/E in ME104 went on to further their skills with the software in their subsequent ME105 course. ME105 is the second course in the graphics sequence with a focus on the design process, manufacturing methods, teamwork, and GD&T among other topics. Through one twist of fate or another, the other author of this paper (Sorby) ended up teaching a section of ME105 in the spring of the 1998-99 academic year. As part of the political maneuverings that resulted in this teaching assignment, she was given permission to teach her section using I-DEAS software instead of Pro/E which meant that the students in that class were forced to learn a brand new package all over again from the beginning. In the scheduling booklet for that quarter, notification was made that I-DEAS software would be used in the section so that students were aware of the fact that they were going to be required to learn a new package if they enrolled in that particular section of the course.

In ME105, students meet for two hours of "lecture" and for two hours of supervised computer lab per week. For the first six weeks of this offering of the course, topics such as teaming and the design process were covered during one day of lecture and demonstrations of I-DEAS software were conducted during the remaining hour of lecture each week. The laboratory sessions during these weeks were devoted to exercises designed to demonstrate the workings of I-DEAS software. Students were also required to complete homework assignments using the software during this portion of the course. For the remaining four weeks of the class, lecture time was spent on topics such as machining processes, thread

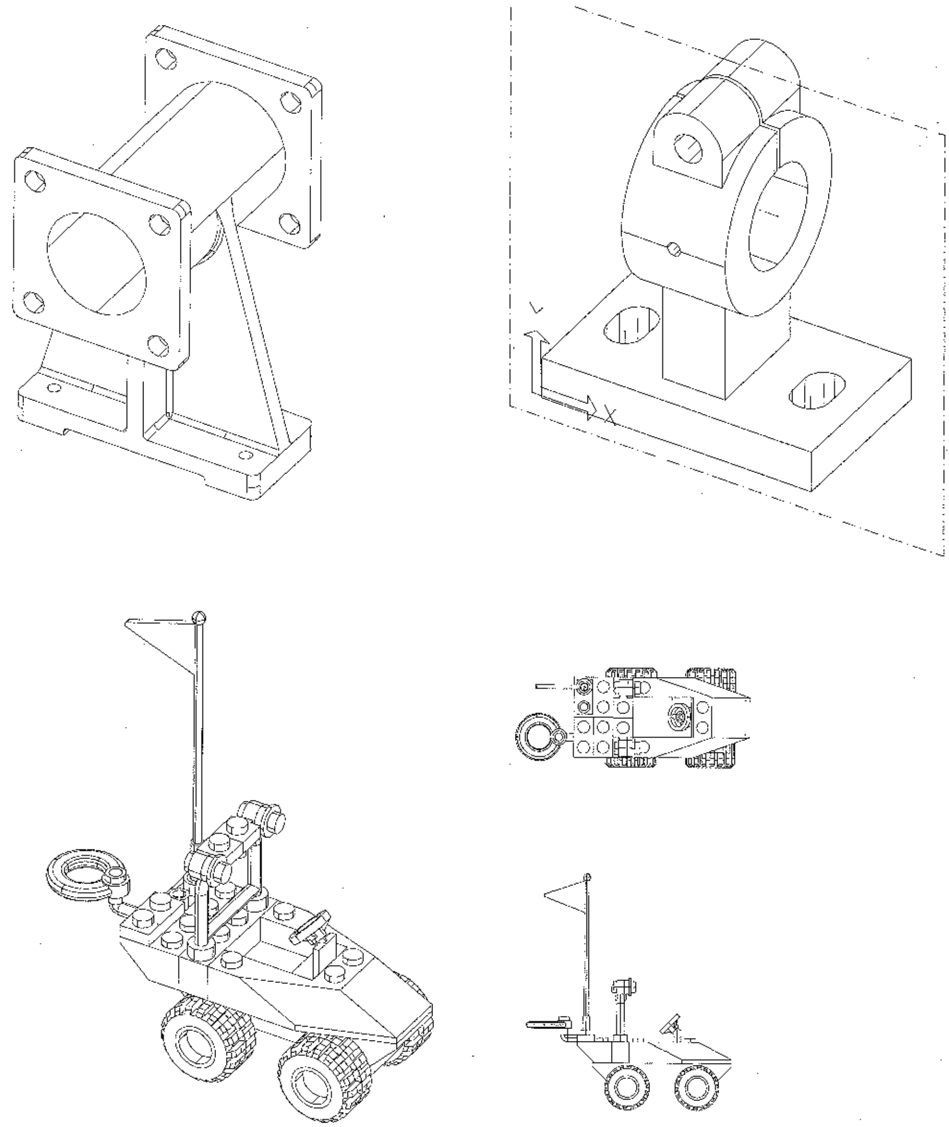

Figure 2 *Sample I-DEAS Assignments from ME105*

specifications, and GD&T. Lab time was open and staffed with a student assistant to allow students time to work on their design project for the course. For the project, student teams of four were required to work together in the design of modular playground equipment. Each team was required to model at least six different modular units and then to assemble these modules in at least three different configurations. Figure 2 shows typical I-DEAS homework assignments completed by the students during the course and Figure 3 shows examples of their resulting design projects.

Thirty-six students (mostly in their first year) enrolled in the section of ME105 that was advertised with I-DEAS instruction. During the first few weeks of this section of ME105, it was noted that there were several comments from students regarding things that I-DEAS did better than Pro/E and things that Pro/E did better than I-DEAS. Through these interactions with the students it was decided that we should survey the students at the end of the quarter regarding some of these issues. At the same time, we were also in the process of making decisions regarding software utilization in

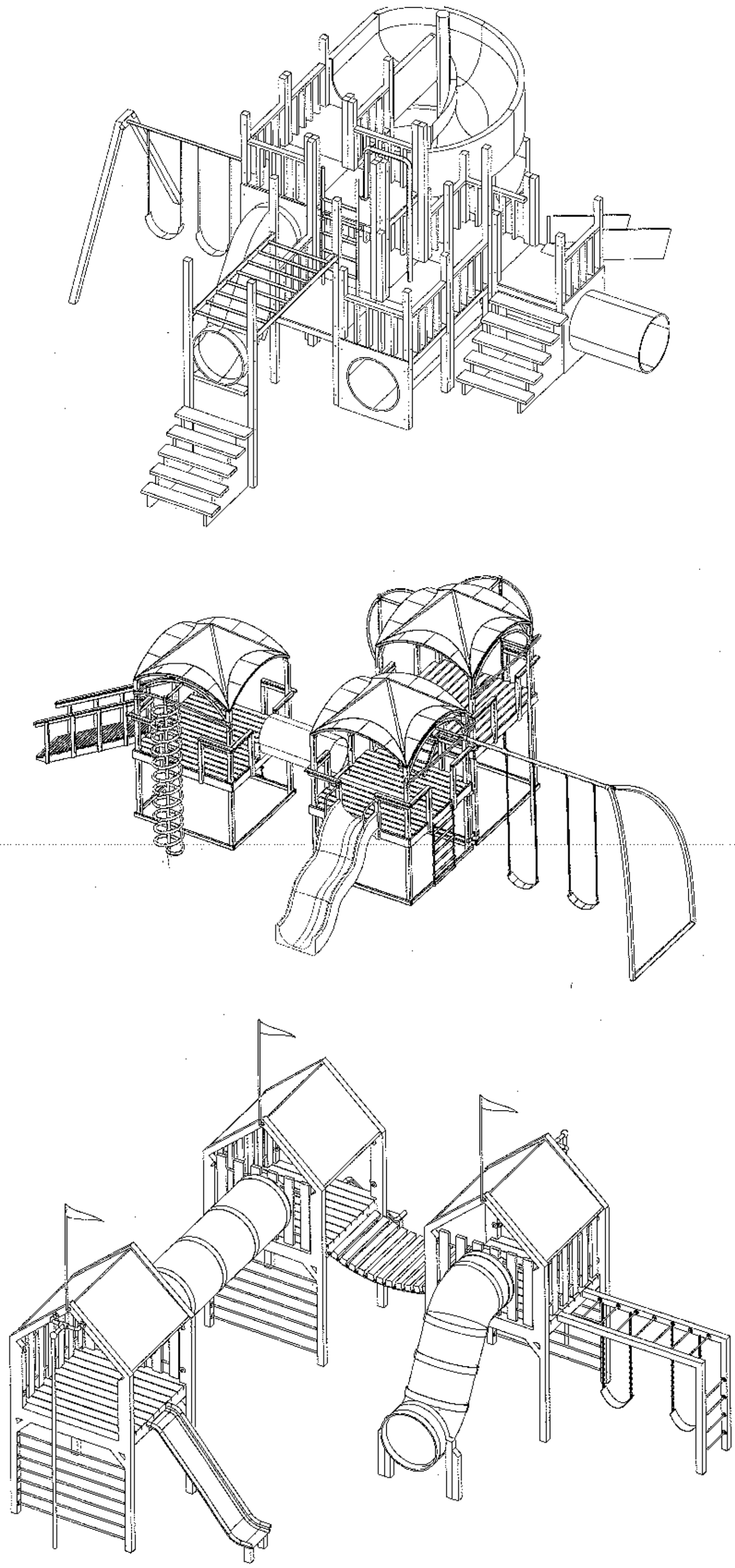

Figure 3 *Sample ME105 Design Projects*

our common first-year engineering program, and we felt that the student perceptions in learning these two packages would be useful in those discussions. The results from this survey are presented in the following.

Survey Results

More than 90% of the students in the section had completed ME104 in either the Fall or the Winter term of the year and had Brett Hamlin as an instructor, so most students had had recent exposure to and work with Pro/E. The students were also asked why they had signed up for this particular section of ME105. Twenty students responded that they specifically wanted to learn I-DEAS software and eight responded that this section fit their schedule best. Two students gave other reasons for enrolling in the section. Representative comments for this question included:

1. It was a very fortunate accident,
2. I didn't know it was I-DEAS,
3. I did not like Pro/E very much. It had a lot of file problems.
4. I was told I-DEAS was a better program than Pro/E.

The remaining questions on the survey had to do with how comfortable they were in using Pro/E and in making comparisons between learning the two software packages. In the following sections, the survey results are presented for each question by the indicated figures. Representative comments, when noted, are also given for each question.

- Before starting ME105, how proficient did you feel you were with Pro/E software? (Figure 4)

- Do you feel that your prior knowledge of Pro/E software helped you or hurt you in your ability to learn I-DEAS and why? (Figure 5)

Representative Comments:

1. All programs are basically similar, and work on the same principles.
2. I knew how to use the computer better than when I started Pro/E.
3. I knew what the basic requirements were for solid modeling an object.
4. Kind of knew the ropes.
5. There are some similarities between I-DEAS and Pro/E.

- Of the two software packages you learned (Pro/E and I-DEAS), which do you think is easier to learn from a student's standpoint? (i.e., starting from scratch) (Figure 6)

- Of the two software packages you learned (Pro/E and I-DEAS), which do you think is easier to use effectively from a student's standpoint? (i.e., you can make it do what you want it to) (Figure7)

- Of the two software packages you learned (Pro/E and I-DEAS), which do you think is easier to use creatively from a student's standpoint? (i.e., you can be "creative" with it when using it) (Figure 8)

- As you may know, Michigan Tech will be moving to a common first year for engineering students in the fall of 2000. We are in the process of determining software packages to be used in the first year engineering courses. Of Pro/E and I-DEAS, which do you think would be more suitable for inclusion in the first year courses and why? (Figure 9)

Representative Overall Comments:

1. I-DEAS is easier to use (14 students responded with comments worded along similar lines—easier to use, easier to understand, easier to learn, etc.)
2. I-DEAS has a better interface.
3. I-DEAS is an easy program to use and become proficient with. By grasping the concepts easier you can do more with the program.
4. I think multiple platforms should be used so that students can see the advantages and disadvantages of different software.

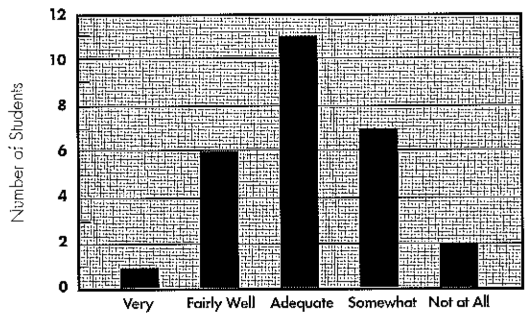

Figure 4 *Prior proficiency with Pro/E*

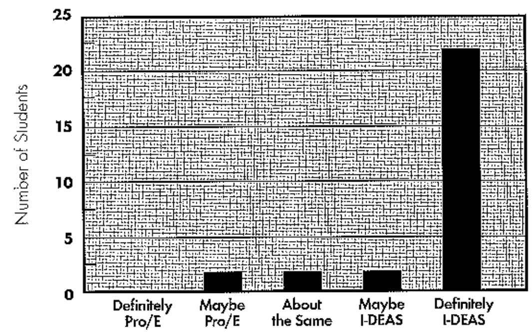

Figure 7 *The Package that is Easier to Use Effectively*

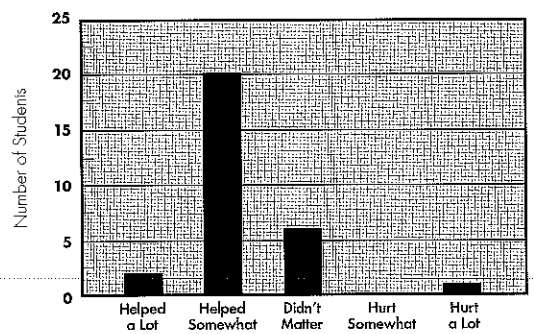

Figure 5 *Assistance from Prior Pro/E Experience*

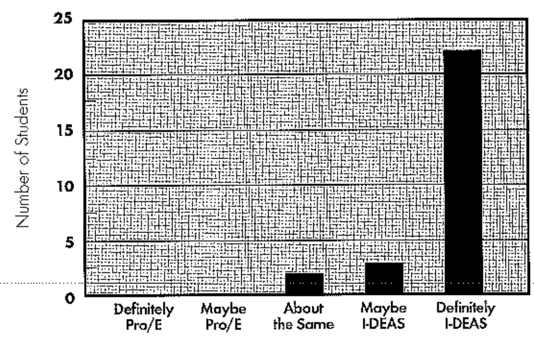

Figure 8 *The Package that is Easier to Use Creatively*

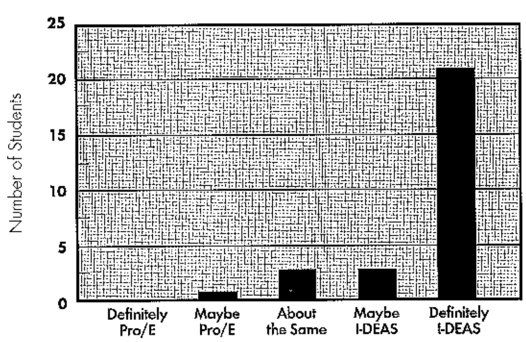

Figure 6 *The Package that is Easier to Learn*

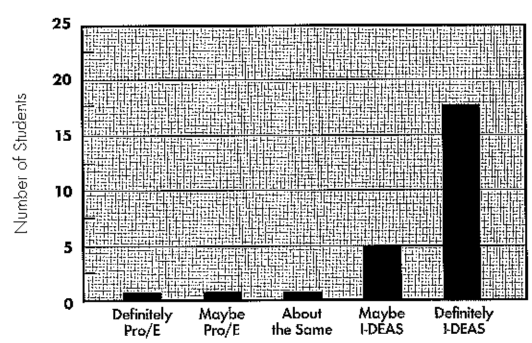

Figure 9 *Recommendations for the Common First Year*

5. I-DEAS is easier to learn and less frustrating to work with than Pro/E.
6. I think if you learn I-DEAS first, Pro/E would be a lot harder to learn.

In addition, students were asked to indicate the features of each software package that they particularly liked or disliked compared to similar features on the other package. Representative comments from the students are presented in the following:

- What features of Pro/E do you like better than similar features in I-DEAS?
1. The way entities are selected in Pro/E is usually easier than I-DEAS.
2. The pull-down menu that stays up so you can see all your options.
3. Only the icons that I can use show up on the screen. So the order of making the project is given.
4. None (10 students responded in this way).

- What features of I-DEAS do you like better than similar features in Pro/E?
1. Most of them. The modeling and assembly set up.
2. Extruding unconstrained parts and drawing.
3. Sharing files in the Library.
4. It's a lot easier to extrude and cut features out of parts.
5. The ability to create 2-D sketches on 3-D parts.
6. Faster, easier to build basic parts and make basic operations.
7. All or Everything (6 students made this comment).
8. Six students commented that the user interface and icons make I-DEAS easier to use.
9. Constraining in I-DEAS is much easier because it shows what is unconstrained much better.

- What features of Pro/E do you particularly dislike?
1. It's too nit-picky.
2. Having to define everything first.
3. That you have to go through like 7 pull down word menus for one alteration.
4. It is menu driven.
5. Four students commented that they didn't like working with the datum planes.
6. Four students commented that they didn't like constraining things in Pro/E.
7. Overall difficult to find things.

- What features of I-DEAS do you particularly dislike?
1. Selecting multiple parts in I-DEAS was either very difficult if not impossible.
2. Library/Bin can be really confusing.
3. There is no Undo.
4. You could not draw on curved surfaces (2 students).
5. There is not a student version available yet (2 students).
6. Master Assembly (2 students).
7. The drafting set up.
8. It's hard to remember what all the buttons do.
9. None (2 students).

Instructor Observations

Sorby has been teaching using I-DEAS software since 1987. She currently teaches a first CAD course for the General Engineering Department (GN135) at Michigan Tech that utilizes I-DEAS for 3-D modeling and IntelliCAD for 2-D drafting. In all, it seemed that the students in this section of ME105 were able to learn I-DEAS much more quickly than students in her typical GN135 course. The questions they asked during in-class demonstrations were at a much deeper level than those normally fielded in GN135. The ability to learn the software more readily when compared to GN135 students was also observed during lab sessions where the TA (who also teaches GN135 lab) noted that he rarely answered any questions—students just came in, did the work and then left. The fact that they seemed to have an easier time learning the software is probably due to the fact that they had the previous experience with Pro/E. As noted by the students—they already knew the basic procedures, they just had to learn to apply them in this new software setting.

In performing demonstrations of how things were accomplished using I-DEAS in ME105, there were several occasions where the classroom "erupted" in comments. This appeared to happen mostly at times where a procedure was perceived as "easier" in I-DEAS than in Pro/E. One example of this was in renaming and modifying dimensions on a sketch. Students commented that in Pro/E there was no way to name dimensions and they had to "remember" the dimension number for each dimension in order to set up equational constraints. The consensus was that this was a "pain" to do in Pro/E and that this seemed much easier to do in I-DEAS.

It is also observed that there are other possible reasons for the students to self report so strongly in favor of I-DEAS over Pro/E. Because students can't unlearn techniques and thought processes developed in the first graphics course, and students may mis-interpret this as the "easiness" of I-DEAS. In ME104 only the basics of the software were taught with the understanding that the student would develop more advanced skills in subsequent courses. Another possible reason student may favor I-DEAS is that the hardware used in the classes were significantly different. I-DEAS users used only Sun Ultra 10 work stations with 20" monitors while Pro/E users worked on Pentium 150+ with 17" monitors. Having taught classes using both I-DEAS and Pro/E, Hamlin points out he prefers certain operations in I-DEAS, for example, combining two independent objects to form a single part-an ability not found in Pro/E. (Students also noted this on their surveys as an improved feature of the software.)

Software Selection Criteria

As educators we make many decisions regarding how and what our students learn. When selecting a software package for use in a course we should keep in mind several factors:

1. ease of learning,
2. ease of use,
3. applicability to industry,
4. ability to integrate throughout the curriculum (i.e., the ability to use the software in more than one course),
5. alignment with the goals of the course, and
6. hardware requirements and cost.

A secondary issue to consider is the amount of technical support a given software company will provide after the decision has been made. However, too many times we are willing to focus only on what industry wants us to teach. We hardly ever consider ease of learning, ease of use and the ability to integrate within the curriculum when making these critical decisions. If we choose a software package that is inherently more difficult to learn and more difficult to use effectively, students will become overly discouraged and we will spend a disproportionate amount of time in training rather than educating. If we choose a software package that is less likely to be integrated within upper division courses within the curriculum, then we will be "wasting our time" and will miss out on an opportunity to work with instructors of upper division courses in the development of a "cohesive" curriculum.

We all seem to agree that if our students learn one package they will have an easier time learning a second, similar package. This seems to be borne out by the students who participated in this offering of ME105. However, instead of choosing the package that is "right" for our students, we often choose the package that is "right" for local industry. If our students will have a much easier time learning a second constraint-based modeler, shouldn't these companies be willing to invest in the limited training necessary for their employees to learn the package that they have in-house? We believe that to let industry dictate the specific software packages we feature in our courses, without considering other important factors, is to provide a disservice to our students.

Conclusions

It is clear from the feedback of the students enrolled in this special section of ME105 that they feel that I-DEAS is a much easier software package to learn and to use when compared to Pro/E. As one student commented on his survey when evaluating I-DEAS: "It was just easier to use. A child could learn how to use this, and I feel you could do more stuff with it." Certainly, the fact that they learned Pro/E first and I-DEAS second has bearing on the results of this survey, however, we don't believe that this means that these results can be discounted out-of-hand. Some would argue that students would tend to favor the first package they learned and not the second. Based on the feedback that we received from these students, and from our own experiences in teaching CAD courses, at Michigan Tech we have decided to utilize I-DEAS software in our first-year engineering courses. We believe that I-DEAS software is superior to others we looked at for each if not all of the factors for consideration. This decision has made some industries in the state happy and others not so happy, however, we feel strongly that this decision is in the best interest of the educational needs of our students.

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2001 ASEE National Design Competition Engineering Design Graphics Division

This year's competition in Albuquerque will not only be challenging and fun, but will also force your students to really stay on target. Participants must design a device that will rapidly fire ping-pong balls at a target placed at distances of 15, 20, and 25 feet. They will be scored by how many they can place on target in only 30 seconds from each distance. The firing competition will take place on Sunday, June 24,2001. Design teams who cannot be there in person may send their engineering design report along with a video, which demonstrates the operating principle and accuracy of their design.

Requirements and Limitations

1. The launching device must be small enough to fit into a 3 Ft. x 3 Ft. x 3 Ft. box while in its ready-to-fire posture.
2. Launch power must be provided by students (Rubber bands, rubber tubing, springs, air pumps, catapults, etc.).
3. Explosive or flammable propellants are not permitted (no potato cannons, fireworks, etc.)
4. Safety guards must be provided where appropriate.
5. Members of the firing team must wear eye protection.
6. Only one ball may leave the launch device at a time.

Scoring Criteria

1. Teams will get one point (1) for each ball that hits any part of the target board before it hits the floor, and three points (3) for each ball that goes through the hole without first hitting the floor. The team score will be the combined total from each distance (15,20, &25 ft). Actual firing can take place during the spring semester at participating colleges and the teacher can send a video (VHS format) to verify the accuracy claimed in the written report.
2. Engineering Graphics is a major portion of the score and must include fully dimensioned orthographic views, an assembly view, and pictorials of the device. Solid models are also acceptable for the pictorials.
3. The target is a 3 Ft. x 3 Ft. square of plywood or cardboard that has an 18" diameter hole in the center. It must have its bottom edge on the floor, facing the firing device, and its back edge must be elevated so that the board makes a 30(angle with the floor. The firing distance is measured from where the front edge of the target contacts the floor to the nearest part of the firing device. No part of the firing device can extend past the vertical plane of the firing line.
4. A typewritten engineering report complete with calculations, trial results, and graphics must accompany the launcher device. This will account for the greatest portion of the team grade. Point values for each element of the report and timely updates will be posted on the contest website at: http://edg.tamu.edu /asee_nedgc
5. A VHS videotape of the device in action may be submitted with the report to accommodate teams who will be unable to attend the contest in Albuquerque. The video should clearly illustrate the operating principle, the physics or mechanics involved, and should include all team members.
6. Teams sizes may be between 3-5 students who are currently enrolled at the sponsoring institution. A single institution may sponsor a maximum of three design teams.

7. The judging for all entries will take place at the ASEE Annual Conference in Albuquerque, NM on Sunday, June 24, 2001 in the exhibit area.

How to Enter

Complete the entry forms and return them to Texas A&M by the dates indicated. They may be returned via surface (snail-mail) or by e-mail to: Vinson@entc.tamu.edu

With the option of using videos in lieu of students making the trip we hope to have a much greater participation than in past years. Hopefully, you and your students are just as excited about this opportunity as we are. We are also creating a website for the contest. Additional details, updates, and information may be found at: http://edg.tamu.edu/asee_nedgc

Thanks for your participation.
Dr. Jerry Vinson, Chairman
2001 National Engineering Design Graphics Competition

Questions

Call Jerry Vinson or C0-Chair Matt Whiteacre at 979-845-1633 if you have any questions. Or email to Vinson@entc.tamu.edu or M-WHITEACRE@tamu.edu

ENTRY FORMS MAY BE FOUND ON NEXT PAGE

Schroff

Graduate Student Participation Grant

Six Graduate students applied for this year's grant. The two students chosen were: Nancy E. Study, working on her Ph.D. in Computer Graphics and Curriculum and Instruction at Purdue University, and Nathan W. Hartman working on his Ph.D. in Technical Education at North Carolina State University. Each received a $500.00 check from Stephen Schroff of Schroff Development Corporation. We thank Stephen for his generosity in funding this yearly grant.

Nancy E. Study

Nathan W. Hartman

2001 ASEE NATIONAL ENGINEERING DESIGN GRAPHICS COMPETITION PROJECT INTEREST FORM

Albuquerque, NM

Our institution is considering submission of student design projects

Number of Freshman projects *(3 permitted)* ____________

Contact person at your institution

Full Name ______________________________

Address ______________________________

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Phone (_____) ___________ Fax (_____) ___________ e-mail ______________

Please mail to: Dr. Gerald Vinson, Texas A&M University, ETID/EDG Department, College Station, TX 77843-3138 or send via e-mail to Vinson@entc.tamu.edu

This form is due by May 25, 2001 or permission by contacting Jerry Vinson at Vinson@entc.tamu.edu

2001 ASEE NATIONAL ENGINEERING DESIGN GRAPHICS COMPETITION REGISTRATION FORM

Albuquerque, NM

All the information on this form should be the same as you wish it to appear on any award.

Advisor(s) ______________________________

School ______________________________

Address ______________________________

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Phone (_____) ___________ Fax (_____) ___________ e-mail ______________

Team Members (limit of five) ______________________________

____

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Please mail to: Dr. Gerald Vinson, Texas A&M University, ETID/EDG Department, College Station, TX 77843-3138 or send via e-mail to Vinson@entc.tamu.edu

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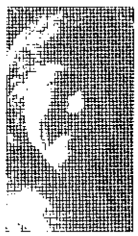
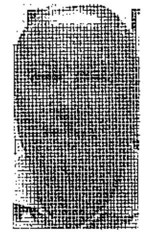
Vice Chair



Sheryl Sorby

Sheryl received a PhD in Mechanical Engineering from Michigan Technological University in 1991. She primarily teaches freshman graphics courses and computer aided design. She currently is an Associate Professor of Civil and Environmental Engineering at Michigan Tech and the Director of General Engineering. She was charged with development and implementation of a common first year engineering program that began in the fall of 2000. Her research and teaching interests are in the areas of spatial visualization and experimental mechanics. She has been actively involved in the EDGD since attending her first meeting in 1994. She was the Program Chair for the Madison meeting and has presented numerous papers at the mid-year and annual meetings of the division. She is a member of the Engineering Design Graphics Journal Review Board.



Moustafa Moustafa

Professor Moustafa received his BS in Mechanical Engineering from the Higher Institute of Technology in Egypt in 1964. He received a Masters of Engineering degree in Machine Design from the University of Illinois in 1976 and another Masters of Engineering in Structures and Stress Analysis from the University of Illinois in 1979. He completed the Ph.D. course requirements in Structural Analysis in Civil Engineering at Old Dominion University.

Professor Moustafa's interest is in the area of Mechanical Systems design such as computer-aided design, computer graphics, 3-D modeling, stress analysis and design for safety. Professor Moustafa is a certified manufacturing engineer and is active in professional societies such as SME, ASME, ASEE and has served in many executive capacities and presented a number of papers in scientific conferences. He also participated in a number of projects with the Technology Application Center at Old Dominion University.

[Director of Liaison]

Patrick Devens

Pat Devens is an assistant professor at VPI & SU and teaches computer-aided design, programming, and engineering fundamentals. He received his B.S. at the United States Military Academy and M.S. in Civil Engineering at VPI & SU. He has authored numerous publications and developed and directed several engineering programs. His project accomplishments include a $23 million renovation and a $30 million new facility. He has managed annual facility operation/maintenance budgets exceeding $2.5 million and provided engineering support throughout the world. He is an active member of the ASEE's Freshman Engineering and Engineering Design Graphics Divisions.

Thomas Krueger

Tom is a Teaching Specialist in the Department of Mechanical Engineering at the University of Texas in Austin, where he has taught since 1994. He teaches the freshman Engineering Design Graphics course and supervises and maintains the prototyping laboratory in the department. Tom has authored several articles on prototyping and has also co-authored several articles with Davor Juricic and Ron Barr. He has helped author the workbook used at the University of Texas in the graphics area. The workbook has recently been upgraded to include both AutoCAD and Solidworks modules. Tom received his bachelor's degree from Concordia College in Seward Nebraska, his master's degree in Industrial Education at Texas A&M University as well as his Ph.D. in Educational Administration from A&M. Tom has taught as an assistant professor in the Engineering Design Graphics Department at Texas A&M University, as a professor in the Engineering Graphics and Design Department at Brazosport College and as an assistant professor in the Engineering Technology Department at Southwest Texas State University. Tom has been a member of ASEE since 1994 and served as one of the co-chairs of the ASEE Mid-year meeting held in San Antonio January 6-9, 2001.

[Director of Programs]

Kathryn Holliday-Darr

Kathryn Holliday-Darr has been an Instructor of Engineering Graphics in the School of Engineering and Engineering Technology at Penn State Erie since 1985. She received her BA in Industrial Arts at the University of Northern Colorado, and her MA in Industrial Arts Education at the State University of New York at Buffalo. Her research and teaching interests include engineering graphics, visualization, and working with freshmen enrolled in engineering technology programs. She is the author of Applied Descriptive Geometry.

Kathy has been a member of EDGD since 1986, presenting papers at ASEE, ASEE-EDGD, International Conference on Engineering Graphics and Descriptive Geometry, and ASEE - North Central Section conferences. Kathy was the 2000 Oppenheimer Award winner. She has also received Penn State University's Provost Award for Collaborative Instruction and Curriculum Innovation (1995) and the Collaborative Instructional and Curriculum Innovation Recognition Award (1996). Kathy served as co-chair for the 1999 ASEE - North Central Section mid-year conference held at Penn State Erie.

Kathy taught Industrial Arts at the high school level for seven years, and is concerned with how unprepared freshmen are for engineering coursework. She would like to help address this issue at the high school level.

Ronald C. Paré

Ronald C. Paré is an Associate Professor of Mechanical Engineering Technology at University of Houston, College of Technology, Houston, Texas (1983-present). At UH he has been a Department Chairman (1985-1986 and 1987-1989) and Mechanical Technology/ Computer Drafting Design Program Coordinator (1990-Present).

Ronald Paré has been a member of ASEE for thirty-two years. He has been active in the Engineering Design Graphics Division since 1970. Engineering Design Graphics Division activities include: Site Host & Facilities Chair 2001 Annual Midyear Conference, General Chairman and Host for the 1979, 1992 and 1995 Annual Midyear Conferences, Program Chairman 1987 Annual Midyear Conference, Secretary (1973-1974), Award Committee Chairman (1972-1978), Creative Engineering Design Display Competition Committee (1970-1977 & 1992-1998).

He is the sole surviving author of a Descriptive Geometry textbook and workbooks currently in their ninth edition. Professor Paré has been teaching CAD via Distance Education and over the Internet for five years.

Professor Ronald Paré has recently received two significant awards for his professional service. In 1997 he was presented the Legion of Merit by the United State Army upon his retirement after twenty-eight years of service as an officer in the United State Army and United States Army Reserve. In 1998 he was presented with the American Society of Mechanical Engineers Dedicated Service Award.

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Papers on various topics related tot his theme are solicited. Abstracts of approximately 200-300 words are due on Friday August 3, 2000. Final papers will be due Monday October 1, 2000. E-mail abstracts to Bob Chin at: chinr@mail.ecu.edu

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Material submitted should not have been published elsewhere and not be under consideration by another publication. Submit papers, including an abstract as well as figures, tables, etc., in quadruplicate (original plus three copies) with a cover letter to:

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