

## **Project Year**

2005

## **Project Team**

Daniel Ursu, Student, Biomedical Engineering Department, Whiting School of Engineering; Daniel Stoianovici, Faculty, Department of Urology, School of Medicine

## **Project Title**

et-CAD; Electronic Tutorials for Computer Assisted Design

## **Audience**

Engineering students enrolled in one of the two classes teaching CAD (Computer Aided Design); Introduction to CAD (530.114), and Computer Assisted Design (530.414).

## **Pedagogical Issue**

Both 530.114 and 530.414 rely on the Pro-Engineer software package for part modeling and drawing, assembly interactions, mechanical simulations, optimizations, finite element analysis and CNC manufacturing. However, most students enter these classes with a shortage of knowledge of Pro-Engineer's more advanced simulation and analysis features. In response, the syllabus has increased in size, to address topics where students seemed to have weaknesses, to integrate as many design and analysis themes as possible, and to cover new features that Pro-Engineer has developed. This approach has increased the amount of material covered in class in the semester, which has not gone unnoticed by students, judging from the grievances in the course evaluation forms. Students still need more help mastering the software, but the courses cannot expand further without the workload becoming prohibitive.

## **Solution**

This project seeks to develop step-by-step PDF tutorials and short videos covering a range of advanced topics in Pro-Engineer, such as motion and force analyses, optimizations, component interaction simulations and finite element analysis.

## **Technologies Used**

Adobe PDF, PowerPoint/Presentation, Digital Video

## **Project Abstract**

This team proposes to create new tutorials for Pro-Engineer, which will be posted online and made available for download by everyone in the student body or the faculty. The increased access to these Pro-E learning resources benefits all of the students enrolled in the two CAD classes at the Johns Hopkins University, by offering them more examples than would otherwise be covered in class. The do-it-yourself, step-by-step tutorials allow students to follow the examples at their own pace, while explanations of what the program is doing and the theory behind the mechanical engineering topics covered are provided as the student follows along. These tutorials are designed to be practical test-

taking review materials, and are printer-friendly. The electronic tutorials are also available as a resource for students who are enrolled in other engineering design classes, and who may choose to use Pro-Engineer to better assess their designs and solve design-related problems. For this reason, the tutorials have been designed to be a crash course in how to use the program, and contain a step-by-step, in-depth analysis of problems which pertain especially to motion and force analyses, parametric optimizations, and finite element analysis of structures. In recent years, Computer Assisted Design software has advanced at a rapid pace, greatly enhancing the modeling and analysis capabilities offered to the user. Consequently, additional training resources that students may review outside of class are greatly needed. Pro-Engineer is now the software of choice for mechanical engineers and is invaluable to engineering undergraduates at Johns Hopkins working on academic team projects such as the Mini-Baja off-road vehicle construction competition, the Microgravity University research proposals sponsored by NASA or the yearlong Senior Design Project, which is required curriculum for all mechanical engineers. Not all mechanical engineers take the CAD classes offered at the University, and those who do are only exposed to some of Pro-E's powerful modeling capabilities. Indeed, Pro-Engineer's capabilities are so vast, that the topics and examples covered in class cannot cover all of Pro-Engineer's capabilities, and students only get a sample of each of Pro-Engineer's features. The additional online resources that this project will develop will increase the students' proficiency with Pro-Engineer, providing extra insight on topics covered in class as well as real world examples. Daniel Ursu, the proposed Fellow for the project, is a biomedical engineering/mechanical engineering student who has taken seventeen design credits in both departments, and has made extensive use of the Pro-Engineer software for his own projects. He has also been a teaching assistant in both Introduction to CAD (530.114) and Computer Assisted Design (530.414), and, in this capacity, assisted fellow students with understanding the software. Daniel will also be responsible for evaluation, including creating pre- and post- tutorial user surveys to determine what difficulties students have with Pro-Engineer and whether those difficulties were addressed by the tutorials. He will implement this survey in 5 engineering classes, and develop an evaluation matrix to analyze the results of the survey.

A video of Daniel's presentation (time=4:08) is available here:

[http://mfile.akamai.com/7111/mov/streams1.nts.jhu.edu/~jhimedia/cer/tfvideos/8\\_et-cad lec.mov](http://mfile.akamai.com/7111/mov/streams1.nts.jhu.edu/~jhimedia/cer/tfvideos/8_et-cad lec.mov)

A link to the Pro-Engineer tutorials is available here: <http://cad.jhu.edu/jhu.html>