Provost's Learning Innovations Grant for Faculty
Request for Full Proposal
2001-2002

Please send your completed grant proposal (4 pages, plus attachments), one original and eleven copies, to
Linda Jones, 4000 Eastman
by 4:30 p.m
Friday, February 16, 2001.
No hand written proposals will be accepted.
Notification of awards will be made by Friday, March 16, 2001.

Project Title: Development of the Interface Between CAD (Computer Aided Drafting and Design) and CAE (Computer Aided Engineering)

Applicant(s):

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Proposal for Provost’s Learning Innovation Grant
By Ti Lin, Liu MMETPS Department, CAST

Title
Development of the Interface Between CAD (Computer Aided Drafting and Design) and CAE (Computer Aided Engineering)

Summary
The objective of this project is to provide a new kind of learning experience and environment for our student to link their CAD with CAE computer simulation courses. As we enter the 21st century, it is challenged as never before in the struggle to meet the demands of the scientific and technological enterprises. Bridging the technical competency gap between CAD (computer aided drafting design) and CAE (Computer Aided Engineering) become one of the priorities to provide highly skilled, better prepared, and well-educated workforce for our industries.

Introduction—Project Goals and Objectives
The mechanical engineering technology (MET) students learn CAD in their lower lever courses during the first two years. The transfer students take their CAD course in two-year community college. With CAD background, MET student CAD can build a mechanical part or assembly solid model. But, in general, CAD system cannot do analysis. The CAD part or assembly file does not give the solution.

15 Years ago, When I became a faculty in MET program, I found that MET student cannot be hired for complicated design and research job due to their mathematical and mechanic background. In 15 years, my major development is integrated CAE—computer simulation tool in my teaching, including developing new courses and new topics. Three major elective courses were developed, including 0610-406 (Dynamics of Machinery), 0610-508 (Machine Design II), and 0610-512 (Computer Integrated Mechanical Design). Also, I use CAE tool for most of my other teaching courses. These CAE tool provides visualization of mechanical part and assembly and their dynamic, structural, and thermo-fluid behavior. On computer screen, my student can see how good or bad is their design. On computer screen, the motion, the stress and deflection, the temperature and fluid flow of their CAD design can be animated with colorful contour.

My student can simulate the real world behavior of mechanical and manufacturing system with functional modeling capabilities in their upper lever courses during the next three years. Due to the mathematical background during last five years, more and more RIT mechanical engineering technology students have been hired by automobile and aircraft industries due to their better CAE skills. Today, it is almost impossible to build a solid model for a complicated part or assembly in CAE system. Most of CAE system has excellent numerical analysis capacity, but is poor in modeling. During last 15 years,
before they can get the analytical results and show the people how it works, my Student
and engineer are struggling to build a good model and meshing for their model in CAE
system. If they could, they will spend 80% time to rebuild a simplified model following
their CAD file in CAE system, which is far away from their real design. The people are
hesitated to accept the results from a simplified model, but they have no choice.
Sometime, the simplified model cannot provide enough information, or might provide
wrong information. For a mechanical assembly, it will be much more difficult. The people
cannot accept the results from a part model, which is actually work in an
assembly.

The interface between CAD 3D model and CAE computer simulation will provide a
bridge between CAD and CAE. This bridge will provide our student a unique learning
environment to analyze, refine, improves, troubleshoot, or non-destructively test a
system. Faculty and student can create 3D models on the computer screen and run “what-
if” simulations with animation, which provide a “Design-Simulate-Verify Process” and a
visualization learning procedure and a visualization-learning environment to our student.
This development will also benefit to the other engineering and technology student in
their design course.

CAD and CAE software came from different software companies. They use different
programming languages, different data processing, and different definition. The
compatibility between that software is poor and there is no low-end version available
commercially.

**My Previous Experiences with CAD and CAE**

1. Developed the teaching material and create new CAD courses in MET, Including
   CAD software CADKEY, AutoCAD, and SolidWorks.

2. Developed the teaching material and create new CAE-finite element analysis
courses in MET, including “GIFTS", SAP, ALGOR SuperSAP, Mechanical Work
   Bench, Working Model 2D and 3D, VisualNastran 4D

3. A series of presentations, Papers, seminars and workshop about CAD, CAE has
   been presented in ASME (American Society of Mechanical Engineering), ASEE
   (American Society of Engineering Education), SME (Society of Manufacturing
   Engineers) and NYSETA (New York State Engineering Technology) during last
   15 years The attendees are educators from other universities and engineers from
   local industry. Some of the summer workshops were funding by New York State.

   To Develop Instructional Materials for Software Packages used in Mechanical
   Engineering Technology”
5. The Grant’s author of the Society of Manufacturing Engineers (SME) Education and ALGOR, Inc. of a finite element analysis software gift for ALGOR EDPAK I, II, III and IV, which including ALGOR software with University site license with value of 19,695, which was received March 1994.

6. The Grant’s author of 1998 from Knowledge Revolution Inc. for Working Model 3D software. The corporate value is $75,000 for 15-computer educational site license in RIT/MET Lab.

7. The Grant’s author of 2001 from MSC Inc. for Visual Nastran 4D software. The corporate value is $220,000 for 20 computer educational site license in RIT/MET Lab. RIT is the sole recipient of MSC “Visual Nastran 4D Version 2001” software annual grant award.

**The Major Impact of This Project in Teaching and Learning**

1. The CAD-CAE interface provides the link and integration between CAD courses and CAE courses. Which will be the major tool in our engineering education. Faculty and student can use CAD in their design courses for kinematics, dynamic, structural (stress and deflection) and thermal consideration.

2. The CAD-CAE interface will provide a new teaching and learning experience and environment in our classroom. 3D interactive computer graphics with realistic image generation, full animation, CD digital sound, and enormous database with provide more effective and attractive learning experience and environment for our students.

3. The CAD-CAE interface will provide the possibility to build the partnership between RIT and industries. With this interface, faculty and student can bring industrial design project into our classroom. Student will develop a working knowledge in their classroom. A strong learning-by-doing, design-and-build experience will provide the great personal satisfaction to our faculty and students.

4. This is a cutting edge research. This project will be the major impact to our MET curriculum, course content, and faculty teaching. All MMET faculty and students will be the beneficiary.

5. There is no low-end commercial solution for this project.
Timetable and Budget Explanation for the Development of the Project.

The major timetable and funding required is releasing one year 1/3 faculty teaching load from March 2001 to Feb. 2002. It will cost $9,000 for the department to hire adjunct faculty. In general, adjunct teaching pay-scale in my department is $3000 per (four credit) course for total three courses in three quarters. $1,000 for purchasing supplies and services for CD pressing, video production, color copies, and others.

Project Evaluation and Final Report

Case study and a set of examples of interfacing will be developed. The application of interfacing in 0610-405, -406, -508, and -512 will be developed. Student, who take these courses will be ask to complete an extensive evaluation form during the end of the course. The evaluation from other faculty in MET program, and from other department will be provided. A final report will be sent to Provost’s Learning Innovations Grant Committee by the end of March 2002.

More information and/or presentation will be provided for this application, if necessary. Please call (x55373) or E-mail (TXLIME@RIT.EDU)

Thanks for your consideration.