

# **Proposal**

**De Ting Wu**

**09-30-2002**

This is the proposal for the application of ACS Teaching with Technology Fellowships. This proposal consists of 7 parts: (1) Rationale for overall project; (2).Description of project; (3).Approach and timeline; (4)Technology and other support; (5).Curriculum and learning outcome;(6).Evaluation and assessment; (7).Dissemination; (8).Budget.

## **Rationale for Overall Project**

The title of this project is “Using technology to enhance teaching and learning of Numerical Analysis”.

Numerical Analysis is a course in the curriculum for students of science and engineering. It is in a special position in the curriculum since it is the course to introduce students how to apply Mathematics that is the central subject of all applied mathematics; it is the course to reinforce and extend students’ understanding of Calculus; also it is the course which needs a lot of tedious and repetitive computations.

The feature of Numerical Analysis is the employ of computational tool to implement enormous calculation. Before the computer-related technology becomes popular, because of lack of computational tool this feature brings some difficulty to the teaching and learning. Since it is very time-consuming to perform a numerical method the instructor just can give the simple problem and students are often scared by complex calculation.

Now, the use of numerical method for analysis, simulation, and design of engineering process and systems has been increasing at a rapid rate in recent years. As technologies are growing the amazingly fast computers are commonplace and powerful software packages make it possible to solve highly complex problems. This development provides the demand and possibility to improve the teaching and learning of Numerical Analysis.

This computing power has enormous potential for enhancing the teaching and learning of Numerical Analysis. In the face of increasing demands on engineering profession to perform better the students who learn Numerical Analysis in preparing to face the challenges of 21st century should learn not only the theory of Numerical Analysis but also acquire skills to use computational tool for computer solution.

## **Description of the project**

There are two overall goals of this research project :

1. To investigate how to incorporate computer technologies into the teaching and learning of Numerical Analysis.
2. To develop new instructional material to enhance the teaching of Numerical Analysis with aid of computer technologies and to assist students in learning of Numerical Analysis.

The specific objectives of this project are listed below:

1. To provide a broadened and intensive discussion of Mathcad --the software which will be used in this project to generate new instructional material.
2. To present an approach how to teach Numerical Analysis by using Mathcad.
3. To supply a variety of relevant problems which are solved with aid of the computer as the examples in the teaching of Numerical Analysis.
4. To acquaint students with the potential of modern computers for solving numerical problems that may arise in their future profession.
5. To give students an opportunity to hone their skill in programming and problem solving.
6. To familiarize students with appropriate uses of powerful mathematical software.

The part which will be done under ACS funding is to develop some instructional Material for Numerical Analysis in Spring Semester of 2003.

### Approach and timeline of project

This project started in the summer of 2002 and will be completed in 2 or 3 years..

2002 summer and fall is the preparation stage. In this stage the work outline will be decided and some of sample will be developed. and other preparation work, for example collection of data, will be done. In November, I'll give a presentation about it in "the Fifteenth Annual International Conference on Technology in Collegiate Mathematics", in Orlando Florida, in November

2003 spring and summer is the work expanding stage. In this stage I'll develop the instructional material and produce a draft of a book which may be named "Mathcad Lab for Numerical Analysis".

2003 fall is the test stage. I'll test the draft in my Numerical Analysis class in fall of 2003. And, hopefully, the book will be submitted for publication at summer of 2004 and a presentation about the book will be given at "the 10<sup>th</sup> International Congress On Mathematical Education" in July of 2004 in Copenhagen, Denmark.

### Technology and Other support

This project needs computer Lab and Math. software of Mathcad 2001(or Maple, Math Lab) for the class of Numerical Analysis.

All of these are available in our college and department.

Also, this project was support by Summer Curriculum Research Grant of Faculty Development Program of Prudential Foundation in summer of 2002.

Now, I'm seeking more help for my project since the grant was for summer of 2002 and your fellowship seems to be for the release time of one course in a semester but my project needs 2 or 3 years. Can you give more support if it is possible?

Also, for academic aspect I'm glad to have someone to consult with if available.

### Curriculum and Learning Outcomes

I'll spend one third classmeets of Numerical Analysis for teaching of computer technology and assign some computer work as home work. Also, in tests and final exam I'll give some problems of computer work.

As mentioned above, Computer technology has enormous potential to enhance the teaching and learning of Numerical Analysis course. It is reasonable to expect:

1. The quality of teaching and learning will be promoted by using computer technology;
2. The students' understanding of Math. will be deepened and their ability of applying of Math. will be raised.;
3. The students' skill to use computer and Math. software will be sharpened;
4. The students' preparation for problems of Numerical Analysis in their future engineering profession will be improved.

### **Evaluation and Assessment of project**

This project can be evaluated from four aspects;

1. Evaluation by outcome—the book which will be submitted for publication and will be subject to the review process of the publish company
2. Evaluation by students: the investigator will conduct a survey of the students who use this instructional material in Fall 2003;
3. Evaluation by conferences: the investigator will give presentation in two conferences and collect comments from colleagues in these conferences.
4. Evaluation by outside scholars: the investigator will collect comments from scholars who use this book through the publisher.

### **Dissemination**

I'll share the results with colleagues through following ways.

1. I'll post some of results in my web site;
2. I'll give some presentation in conferences;
3. I'll try to publish a book to share the results with colleagues.

### **Budget**

This stipend will be used for the cost to replace the teaching of one course in Spring of 2003.

Submitter

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09-30-2002