

Archive of BEE Educational Software Manuals: An Overview

(J. Robert Cooke) 12Oct2015

We had used a handheld, programmable calculator (HP-65) and a desktop HP-9830 calculator using BASIC for our scientific work to supplement mainframe computing. But from 1986 through 1993 our group was involved intensively in the creation of educational software. Initially, we used an Apple II (using BASIC) and then Macintosh and IBM-PCs (XT & ATs) microcomputers.

Utilizing the built-in graphics of the Apple II, we ported finite element software written for a mainframe by Larry J. Segerlind and his students at Michigan State University for elasticity and steady state diffusion. That code was command line-based and did not provide a visual interface for either input or output. Providing a graphical interface and shoe-horning code written for a mainframe computer onto a 64K computer with a disk drive represented a significant challenge.

We produced a book that was published also by Segerlind's publisher, John Wiley.

Cooke, J.R. and D.C. Davis. 1986. *Applied Finite Element Analysis: An Apple II Implementation*. John Wiley and Sons, NY. 448 pages.

We provided camera-ready copy to John Wiley & Sons.

Our next project was to produce an auxiliary tool for word processors to handle the two-dimensional formatting of mathematical expressions. In a full "what you see is what you get" mode, two-dimensional mathematical expressions were formatted and then 'pasted' into a word processor file. If any editing was required, the expression had to be transferred back into the editor, *MathWriter I*, for editing and then re-transferred back into the word processor. Nevertheless, many copies were sold worldwide.

Jae Young Lee, a graduate student, created a finite element program for elasticity that was implemented on a graphics-supported IBM-PC AT. Excellent three-dimensional rendering was provided. He pursued this in subsequent years and created *VisualFEA*, research level software.

With the advent of the Apple University Consortium, Macintosh computers, with a desktop visual environment and mouse, became available. We then implemented a highly visual finite element for two-dimensional and axisymmetric elasticity and for Poisson's equation (steady state heat conduction, steady state diffusion, etc.) *MacElastic* and *MacPoisson* were born. Pre-windows environment versions were created for IBM-PC-XTs. [The suite of finite element software listed above (plus the PC software versions) was honored by EDUCOM in 1992 by including it in '101 Success Stories of Information Technology in Higher Education: The Joe Wyatt Challenge' Judith V. Boettcher (ed) 1992. McGraw-Hill, Inc. 601 pages.]

Robert Oaks, a masterful programmer, created *DiskManagerPC* to provide a supplementary attribute system for the file system. This brought to the distributed computing environment capabilities that were available with mainframe computing, e.g., control over tampering with commercial software and removing files that might have been left unintentionally on public clusters of distributed computers. Serendipitously, this provided an early protection scheme against 'viruses'.

We then turned to specialized databases. Years earlier I had created a course grade- management database for the Apple II. Now we wrote a sophisticated course management program, *MacRegistrar*, that was widely used across the Cornell campus (free) to manage grades for large courses. The course enrollment data could be downloaded from the University Registrar and imported (without retyping) into the program. Grades could then be added during the semester and final grades computed within the program before the course grades were exported back to the University Registrar—eliminating many hours of tedious, error-prone data entry.

Our research on stomatal control of gaseous diffusion into and from higher plants was computationally (rather than experimentally) based. Our HyperCard-implemented summary of that work (*StomateTutor*) was honored in 1991 with an ASEE honor of the “Outstanding Teaching Materials Award”.

Our Macintosh software, MacPoisson, was further polished and verification studies were provided. This package was honored by EDUCOM in 1989 with top place in a national competition (for all fields of engineering and all computer platforms) as “Best Engineering Software”.

These we complemented with pre-Windows computer implementations on IBM-PC XTs, *PC-Elastic* and *PC-Poisson*. Likewise, we created a pre-windows database for managing course data. Under contract with Peterson’s Guide we also developed a database for handling graduate admissions work (GradTracker).

In our most ambitious project, we decided to create de novo a scientific word processor in which formatting mathematical expressions would be fully implemented with status comparable to the handling of one-dimensional strings of text characters, *MathWriter II*. We intended this program to be so fluid as to allow faculty to compose their manuscripts in MathWriter II, rather than writing the equations on paper for transcription by a secretary. Books actually were written and published in this manner using MathWriter II output. [Sadly, Microsoft derailed our efforts by bundling an expression formatting tool to Word as a free add-on.]

When we were unable to secure development funding for further development of MWII, we undertook the creation of a MathWriter II add-on database for generating tests from data banks of test items, *ExamBuilder*. MWII provided the formatting engine. That worked beautifully, but sadly, diverted us from continuous development of MathWriter II. During the course of creating MWII, user priorities shifted from a primary focus on “features” to “stability”, which required a significant and expensive testing phase.

Our final project was the creation of a bibliographic database, *DiscoverPro*. This provided an environment for managing not only text, but video resources. Traditional bibliographic programs dealt exclusively with text citations.

URLs for BEE Software Manuals:

A Guide to ExamBuilder <http://hdl.handle.net/1813/39153>

MacRegistrar: A Specialized Database For Course Information : <http://hdl.handle.net/1813/40847>

MacPoisson Supplement: Instructional Finite Element Analysis Verification and Problem Sets : <http://hdl.handle.net/1813/40846>

Applied Finite Element Analysis: An Apple II Implementation: <http://hdl.handle.net/1813/40841>

DiscoverPro: The Bibliographic-Multimedia Database; <http://hdl.handle.net/1813/40842>

Software by J. Robert Cooke: <http://hdl.handle.net/1813/40843>

MacElastic : Instructional Finite Element Analysis for Solving Elasticity Problems With the Macintosh: <http://hdl.handle.net/1813/40844>

MacPoisson: Instructional Finite Element Analysis for Solving Poisson’s Equation With the Macintosh: <http://hdl.handle.net/1813/40845>