

Research on the Use of Mathematica Software to Carry out Numerical Analysis Teaching

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Abstract—The numerical analysis course which is a widely applied and strong discipline mainly introduces the basic theories and methods of scientific computing. This paper discusses teaching concepts, textbook content, teaching links, and teaching methods combined with Mathematica software.

Keywords—Numerical Analysis; Mathematica software; teaching research

I. INTRODUCTION

Numerical analysis known as numerical calculation method is a mathematical course[1]. It is suitable for computational methods used on computers and its error analysis and convergence and stability problems. Meanwhile, Mathematica software, Matlab software and Maple software are known as the three major mathematical softwares, and are internationally recognized as accurate and reliable scientific computing softwares. This paper examines the teaching reform of the numerical analysis course in the Mathematica software environment. The main goal is to strengthen the classroom teaching of numerical analysis in the Mathematica software environment, optimize the construction of numerical experiments and network teaching platforms, improve the ability of students to design language programs in Mathematica software, and use algorithms to solve practical problems[2].

II. DESCRIPTION OF THE MATHEMATICA SOFTWARE

Mathematica software is a specialized mathematical calculation software[3]. It was developed by Wolfram Research software company where located near Lino Champagne University in Lino, USA. Since 1988, it has been widely applied to engineering, mathematics, computer science,

economics, biological, medical, bioscience, space science and other fields. It was deeply loved by scientists, students, professor, researchers. Papers, the science report, journal, literature, computer graphics are all Mathematica software masterpiece. It's a symbolic computation and a software system for Math. It can be done any work on the computer and do calculation problem. It also can draw with a command when only date or function is given. Meanwhile, Mathematica software can establish hedge funds trading site and publish the interactive engineering textbooks and development of embedded image recognition algorithm. It can do almost any workflow involved in the result. It also includes the real time 3D model of the mathematical object, built-in the function of image processing and image analysis. Supporting the genome, chemical, meteorological, astronomy, financial, Mathematica software becomes a powerful tool for learning and scientific research work.

III. THE CHARACTER OF NUMERICAL ANALYSIS COURSE AND THE EXISTING PROBLEMS IN THE TEACHING

Numerical analysis as a course in a university of science and engineering, involves a wider range of learning content, such as error analysis, solution of linear equations, interpolation method and data fitting, numerical differential and integral nonlinear equations and solutions, numerical solution of ordinary differential equations. By learning, students can master the structure principle of numerical method and use the method correctly in the actual problem and can also give reasonable explanation of some phenomenon, such as the error of the method, the convergence, the analysis of problems. At the same time, students are required to have

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some certain computer programming ability, including the ability of writing a program to common numerical method and running on a computer. According to the book, the formula derivation and algorithm in this course are much more. The amount of calculation is relatively large. If the whole class is the formula derived, without actual presentation process. It will be difficult to arouse the enthusiasm of students. Boring learning will cause students losing interest, also influencing students to interact with the teacher's. For example, in the cubic spline interpolation, the function calculation is complicated, but if in combination with Mathematica software, the calculation can be simplified. Students can also write programs to realize the interpolation process[4].

IV. THE TEACHING OF THE NUMERICAL ANALYSIS COURSE BASED ON MATHEMATICA SOFTWARE

A. *Numerical analysis teaching completed by realizing specific instances in Mathematica software*

The numerical analysis course has strong applicability and complexity of teaching content. In the teaching of numerical analysis course, teachers can interpret the basic concepts and main methods that are difficult to understand in the course with as many concrete examples as possible. It is a good attempt to reform the teaching of numerical analysis course. Therefore, combined with the characteristics and problems of the theoretical teaching of numerical analysis, teachers can improve the teaching effect of this course only by improving the traditional single teaching mode, so that students can have a complete understanding and mastery of what they have learned[5]. For example, teaching, if we use Mathematica software, we can easily implement a large number of complex numerical calculations and graphics. But it is difficult to solve the same problem with traditional teaching methods. For example, when teachers teach curve fitting, they can use the population growth as an example to realize the teaching. Such as the manufacture of hull, car shape and aircraft wing and other practical problems and spline interpolation problems, missile tracking problems and the problems of numerical solutions of differential equations, etc., we can easily use the existing functions provided by Mathematica software to directly obtain the results we want.

B. *Mathematica software is an ideal tool for deepening the teaching reform of the "Numerical Analysis" experiment course*

Because "Numerical Analysis" has more teaching content, less teaching time and even less time for experimental courses, improving the experimental environment of "Numerical Analysis" and improving the experimental results is to promote the teaching reform of the "Numerical Analysis" experimental course. Mathematica software has many features, such as easy to learn, short and efficient code, powerful computing, easy graphics drawing and processing, and high-performance numerical computing capabilities. Using Mathematica software as an experimental platform in the teaching of "Numerical Analysis" experiment courses can effectively improve the teaching efficiency of teachers,

improve students' interest in learning and the effect of learning, and deepen students' understanding of the mathematical principles and methods involved in the course. It provides an effective teaching method and way for students to complete complex calculations quickly and accurately. It can enrich the students' learning mode and training mode, improve students' ability to apply what they have learned and solve practical problems[6].

C. *Using Mathematica software for experimental teaching of numerical analysis courses*

Experiment is an important part of numerical analysis course teaching, and it is an important process for students from theoretical knowledge to practical application. The use of computers for mathematical experiments has become an important means for students to deepen their understanding of what they have learned, but it is more difficult to implement them in C language. And if the algorithm is not well chosen, you may get the wrong result. Moreover, drawing graphics is also a difficult point in the C language. And if we use Mathematica software to implement it will be very easy. Because it has powerful computing functions, graphics processing and a good interactive interface. Therefore, it is an ideal tool for numerical experiments. For a complex C language algorithm, Mathematica software only needs to directly call its existing function, and plus a few simple statements to get its graphics. Moreover, the resulting graphics are beautiful and accurate. In the process of numerical experiments with Mathematica software, students not only mastered the teaching content through digital combination, but also deeply realized the charm of modern computing tools. While reducing the pressure on students' learning, let students learn the course more actively.

D. *Reform of the examination method for numerical analysis courses*

The test method for numerical analysis is generally a written test, and the final score is calculated by the sum of the mid-term and final-end written test results proportionally. This assessment method is simple and easy to operate. But this is one of the reasons why students don't pay much attention to experimentation and don't pay attention to how to solve practical problems with what they have learned. In order to enhance students' awareness of using mathematics knowledge to solve practical problems and improve students' computing ability, the examination method is changed into two parts: written test and computer experiment. The experimental part of the computer is arranged by the teacher at any time according to the progress of the lecture, and is completed by the students in the Mathematica software environment. Written and experimental results are recorded in proportion to the final grade of the course.

V. CONCLUSION

The above is the initial practice and assumptions of the numerical analysis course assisted instruction in the Mathematica software environment. Mathematica software is an important platform for assisting instruction in

numerical analysis courses. We still have a lot of work to do, such as how to better utilize the functions of Mathematic, enhance the interaction between teaching and learning, and improve the effectiveness of classroom teaching. The use of Mathematica software experiments to enhance students' hands-on ability has to be further explored.

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