

The Significance of Applying MATLAB to the Teaching of Basic Mathematics Courses in Colleges and Universities

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Abstract

With the development of modern science and technology, the application of MATLAB to the teaching of mathematics basic courses in colleges and universities has received more and more attention from mathematics teachers. This paper starts from the analysis of the application status of MATLAB in the basic courses of mathematics in colleges and universities, and combines the teaching practice to explore the significance of applying MATLAB to the teaching of mathematics basic courses in colleges and universities, and puts forward some points that should be paid attention to in practical teaching.

Key words

Mathematical Thinking, MATLAB, Teaching Reform

I. Introduction

Mathematical basic courses such as advanced mathematics, linear algebra, and mathematical statistics not only occupy an important position in the field of science and engineering, but also gradually penetrate into various fields such as economy, management, and humanities and social sciences. They are important means and tools for scientific research in various disciplines. Its wide application value is increasingly valued by people. With the development of the times and the deepening of education and teaching reform, teaching innovation and improving the quality of teaching, so that students have a reasonable knowledge structure and a strong ability to adapt to future work has become the direction of teaching reform. Integrating mathematical software into advanced mathematics and other courses, integrating mathematical knowledge, mathematical modeling and computer applications, [1] using MATLAB software for efficient numerical calculations, symbolic operations, and powerful digital visualization functions, not only helps to understand Mathematical concepts, theorems, etc., can reduce the waste of time and energy caused by complex operations, and improve students' enthusiasm for learning mathematics. To lay a solid foundation for their future professional study, research activities and further study. Making full use of information technology means that teaching is more three-dimensional and vivid.

Based on matrix operations, MATLAB integrates high-performance numerical calculation and symbolic calculation functions, powerful drawing functions, dynamic system simulation functions, and numerous application toolboxes. It is a unique and influential scientific computing software in science. Research and engineering applications have a wide range of applications. "In European and American universities, textbooks such as matrix algebra, numerical analysis, mathematical statistics, automatic control, digital signal processing, analog and digital communication, dynamic system simulation, etc. all have MATLAB knowledge. In European and American universities, MATLAB is the same as advanced mathematics. It is the basic tool that must be mastered by undergraduates, masters and doctoral students who are studying for a degree. In China, such as Shanghai Jiaotong University, the new engineering "Advanced Mathematics", "Linear Algebra", "Mathematics Statistics" are also based on MATLAB and Mathematica software. New teaching tools." [2] Many major universities in China have applied MATLAB as a compulsory course, but in many mathematics basic courses in colleges and

universities, the application of MATLAB related knowledge is still quite small, with Shandong University of Technology as the For example, Shandong University of Technology has a total of 26 colleges, 70 undergraduate majors, and more than 33,000 full-time undergraduate students. It is a science-based school. In the mathematics basic courses such as advanced mathematics and linear algebra, the mathematics software is introduced. There are only 8 majors in the school that offer relevant MATLAB electives or compulsory courses. The students who know this software are less than 10%, and the coverage is small. If you apply MATLAB to the teaching of mathematics basic courses, it will not only help the teaching of mathematics basic courses, but also let most students understand the knowledge of MATLAB software.

II. Discussion

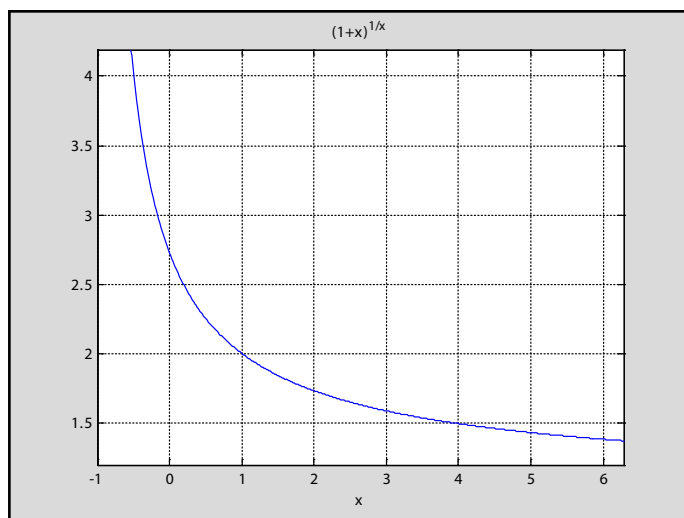
1. The significance of applying MATLAB in the teaching process of mathematics basic courses in colleges and universities

With the rapid development of modern science and technology and information technology, higher requirements are placed on the quality and creative ability of talents, and education reform is also promoted and promoted. The application of MATLAB experimental teaching in the teaching process of college mathematics curriculum is the need to cultivate applied talents. It is the responsibility of every mathematics educator and an effective means to improve students' enthusiasm for learning.

1.1.As a math teacher, it is the responsibility of the mathematics teacher to introduce excellent mathematics software to young students. Academician Li Daqian pointed out in the article [3] that "the teaching of university mathematics courses should never be positioned to impart only a variety of mathematical knowledge to students, and only teach them a system that is seamless from definitions, axioms to theorems, and inferences." We should teach mathematics to teach mathematics, know its ins and outs, and apply mathematical knowledge to solve practical problems. Applying MATLAB to the relevant knowledge points of mathematics basic courses, using computer means to demonstrate the content of concepts and theorems, and visually display the development process of knowledge, so that students can better understand mathematics ideas, and the teaching forms are flexible and diverse, which is conducive to improve Students' interest in learning

For example, when we analyze the trend of the function

$f(x) = (1+x)^{1/x}$ as $x \rightarrow 0$, we can enter “>>ezplot('(1+x)^(1/x)'), grid on” in the command window. By use MATLAB, we can make a graph of the function as following.



The graphics drawn by MATLAB enhance the geometric intuition. It is undoubtedly helpful for students to understand the concept of extremes, allowing students to make in-depth observations of mathematical phenomena through geometric figures, understand the basic ideas and typical methods of theory, and deepen the concept of abstraction. The perceptual knowledge enables students to experience the discovery process, guessing verification, sensible reasoning, and brain-learning learning process.

1.2. Stimulating students' enthusiasm for learning mathematics, cultivating innovative consciousness, and improving their ability to analyze and solve problems. In the process of mathematics teaching, consciously join the MATLAB mathematics experiment, students use the software, mathematics knowledge and skills to carry out exploratory research and creative learning. Not only can students deepen their understanding of mathematical concepts, but they can also solve problems quickly and accurately, freeing students from cumbersome and sometimes mechanically boring mathematical calculations, making them feel happy, learning the fun of learning, and being able to pass My own thinking develops and utilizes software, laying a good foundation for future study and research work.

For example, in linear algebra, calculating the value of a determinant is a cumbersome mechanical mathematical operation, and MATLAB is completed with a simple “det” command, avoiding complicated mechanical calculations and saving students a lot of valuable time. The specific method is: after introducing the concept, nature and calculation of the determinant, we naturally introduce the MATLAB command det, and the operation of the command can quickly and accurately find the value of the determinant, and increase the student's happy feeling and improve learning through contrast learning. interest. Teachers can also further guide students to think about the calculation of the n-by-n determinant.

For example, when calculate

$$\begin{vmatrix} 1-a & a & \cdots & 0 & 0 \\ -1 & 1-a & \cdots & 0 & 0 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 0 & 0 & \cdots & 1-a & a \\ 0 & 0 & \cdots & -1 & 1-a \end{vmatrix}$$

, students will be willing to think, discuss, and finally write a command statement (M file):

```
>>syms a
input('input n=')
A=(1-a)*eye(n);
for k=1:n;
A(k,k+1)=a;
A(k+1,k)=-1;
end
A
```

When running the code, enter n=4 in the command window to get the result of the 4-by-4 determinant:

```
A = [1-a, a, 0, 0]
[ -1, 1-a, a, 0]
[ 0, -1, 1-a, a]
[ 0, 0, -1, 1-a]
ans = 1-a+a^2-a^3+a^4
```

In this way, students will do the 5-by-5 and the 6-by-6 determinant, and naturally will summarize the results of n-order: $|A_n| = 1 - a + a^2 + \dots + (-1)^n a^n$. In this process, the students are active in thinking, actively conducting exploratory research. When they see the results on the screen, they feel excited, satisfied, and sighed. Therefore, the appropriate addition of MATLAB experimental teaching in teaching, guiding students to learn creatively, can receive unexpected positive effects.

1.3. Infiltrating MATLAB knowledge in mathematics teaching is a requirement of social development. The talents needed in modern society are the foundation of science and culture, the ability to innovate and work, and the ability to solve practical problems, and have a large space for personal development. Students learning MATLAB software while studying mathematics basic courses can not only improve students' interest in mathematics learning, but also enable students to master the basic knowledge of mathematics more firmly, and understand the application and development of mathematics software, and lay down the students' future study and research work. It can also enable students to correctly use advanced technology and the Internet to avoid indulging in video games and the unhealthy online world.

2. The problems that should be paid attention to in teaching

2.1. It is clear that MATLAB is applied to the teaching of basic courses in mathematics, rather than using the content of MATLAB to occupy the position of mathematics courses. “The original system of the main courses of mathematics is a product that has been accumulated and tested over the years. Without sufficient basis, it cannot be easily changed.” [3] We must naturally infiltrate MATLAB applications in the process of teaching mathematical ideas and theories.

2.2. Avoid taking up too many hours of study and increase the learning burden of students. This requires teachers to be brave in exploring teaching reforms, rationally organizing classroom content, improving teaching methods, and improving teaching efficiency. At the same time, teachers are required to have rich teaching experience, have a high degree of control over the key points of mathematical theory knowledge, and are familiar with the application of mathematical software. Under the premise of

the current class time, the original system of mathematics basic courses is not changed; the deduction of pure mathematics theory is appropriately reduced, especially the process of numerical calculation and mechanical calculation. Introduce and introduce the application and application of MATLAB software in a timely manner, without dragging the water, not cumbersome and bloated, without increasing the student's learning burden; making the classroom teaching lively and vivid, and enriching students' interest in learning. Only by letting students become interested in mathematics learning, no longer feel boring, feel useful to the knowledge they have learned, and can be applied in subsequent learning, the teaching objectives will be realized and embodied.

2.3. Select appropriate topics according to the content of the teaching, and let the students finish the work after class (note "fine" and "less"), so that students can experience the convenience and happiness brought by using mathematical software to solve mathematical problems.

III. Conclusion

Applying MATLAB to the teaching of basic mathematics courses in colleges and universities, cultivating qualified personnel with solid basic knowledge and innovative ability is the teaching reform idea that every mathematics educator should actively think about and explore practice.

References

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