Reflections on the Teaching of Computational Methods

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Abstract

Computational Methods is a basic course for science and engineering students.Combined with the usual teaching work, this paper propose two aspects: the change of teaching design and the close combination with practical problems.Two aspects should be paid attention to in the teaching process.

Keywords: calculation method; Instructional design; practical problem

Computational Methods is a public course for science and engineering students.Most class hours are set to 32 class hours. How to better let students master this course in a limited class hour is a problem that needs us to think about.Some authors have given many methods in [1] - [3].

I Present situation

Computational Methods is generally offered in sophomores or junior colleges with a certain foundation of advanced mathematics and linear algebra. However, many students have many professional courses at the same time.Therefore, it is a great challenge for teachers to set up this course. Every teacher needs to think how to make students like and master the content of this course.

II Heuristic teaching

Some students think that “Computational Methods” is “Advanced Mathematics”. under these circumstances, How to make students like this course is the first problem to be solved. Through the usual teaching, we can start from the following specific aspects.

1. Changes in instructional design

The students should understand the differences from advanced mathematics and linear algebra.

(1) Definite integral

We review the method of calculating definite integral. The students calculate definite integral by Newton Leibniz formula. In this case, we will ask the students questions: How to calculating the integral $\int_0^1 \frac{\sin x}{x} dx$. At this time, we lead to the idea of numerical integration in Computational Methods .

(2)System of linear equations

We think about the solution of system of linear equations. Many students think that Gauss elimination method and Cramer's Rule are good methods to solve system of linear equations. We solve a large-scale linear equations by Gauss elimination method and Cramer's Rule.It take much time to calculate results. Therefore, we need other method to compute, such as Doolittle Decomposition, square root method, method of iteration.

(3)Nonlinear equations

The quadratic equation has a root formula. We consider how to find the root for cubic and above.

From the above three aspects, students can understand the content of calculation method as a whole.

2. Combined with practical examples

Combined with practical problems, we can better understand the characteristics of the course of Computational Methods. For example, "Butterfly Effect" is mentioned before "error propagation and accumulation", which is more helpful for students to understand the propagation and accumulation of errors. When we discuss interpolation polynomials and fitting curves, we give the example "data table between height and weight", and get a set of data through measurement. The

height corresponding to different weight is different. Think about how to find the relationship between weight and height? There are two methods: (1) It can be done by polynomial interpolation. (2) You can do it by fitting. We give the comparison of the above methods. Thus, students can better understand that learning Computational Methods is not only theoretical analysis, but also closely combined with practical problems.

III Summary

In teaching the course of Computational Methods, we should constantly accumulate experience . Students really feel that this course has practical value and solve some problems in engineering.

References

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