Experimental Mathematics for Teaching and Learning Mathematics

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Why Experimental Mathematics?

Mathematicians often pursue perfect elegance and complete logical structure of all its entity. This often leads a beautiful proof of a Theorem which seemingly came from heaven but not from the earth. That is why still some mathematicians argue about the proof of the Four Color Problem. Brute force…. an ugly proof…. or not a mathematical proof at all! Even though we all awed for those genius works done by such brilliant people, that is not certainly the way that all our students learn mathematics. Often, our students do not have a complete mathematical structure in their mind. Hence, they do not build a complete axiomatic system and set of precise definitions which lead them a series of Lemma to conclude a perfect proof of a mathematical Theorem. Rather they seemed to learn mathematics through a series of trials and errors, say, experiments.

Why Computation?

Certainly, mathematics can be learned without computational tools at all. However, with advanced computational software, such as Matlab and Mathematica, one can learn mathematics with more fun. Moreover, one can stretch their problem-solving skills to much more complicated problems than textbook exercise problems, such as real-world problems from BIG (Business, Industry, and Government). These real-world problems certainly add strong motivation to many students to learn mathematics. Also, a powerful computational tool empowers the students to engage in research (in a certain form) right away. As a result, they start asking good questions by themselves which leads to a good cycle of learning mathematics.

Why Matlab?

Matlab is a computer program language but it is a friendly interpreter rather than a quiet compiler. It even responds with humor when you type “why”! (After you spent an hour with the frustration of finding a logical error!) The code can be easily readable and less cryptic than other computer languages for beginners. It also has many built-in mathematical functions so suitable to implement your mathematical conjectures or experiment your algorithms. It is also easier to debug and to visualize the numeric results, which are really essential in much experimental mathematics and real-world problems. If needed, one can even adopt a set of proven algorithms in terms of a specialized toolbox. Even though, there is a list of public domain software for scientific computation, Matlab, as commercial software, also provides a very reasonable academic license. Well, at least, it is a tool of my choice of experimental mathematics.