An engineer looks at mathematics

LEE Chak-Hong
Project Manager, Varitronix Limited

As a mathematics graduate of the University of Hong Kong, I have received rigorous training in the knowledge of mathematics and fruitful development in analytical power. As a bonus, I have also learnt from my teachers during the undergraduate and postgraduate years to admire the beauty of mathematics. There are definitely many beautiful theorems in various branches of mathematics (e.g. to name a few, algebra, geometry and topology) that I think are the treasures of the great mathematicians after years of intellectual effort. Our teachers open up the minds and horizon of students like me in their incubation period, which has much positive impact on a student's later academic research life.

I initially engaged in the application of advanced mathematics to solve practical problems during my M.Phil. study at the University of Hong Kong. Later on, I pursued my Ph.D. study in electrical engineering at Cambridge University. My doctoral research involved an amount of deep mathematics (e.g. functional analysis) applied to real-world practical problems. The solution of my physical problem does not just stop at acquiring the solution in mathematical formulation, but also uses digital signal processors to implement my design, based on some rigorous mathematical proof, on a real consumer CD player. My own design does perform much better in quantitative measures than that of the then existing CD player. Beautiful music played on a CD player of my design exhibits experimentally the accuracy of the underlying mathematical modelling and analysis. The feeling is so real and striking to witness how the mathematical calculation and reasoning on paper so accurately and precisely reflect the real world mechanism. This striking experience broadens my perspective of the "beauty" of mathematics.

As a young mathematics graduate, I visualize the beauty of mathematics as certain systematic interconnections between some abstract objects. These interconnections are proved by logical implications step by step. This wonderful “virtual” picture shows how complex and analytical our brain is but, unfortunately, can only be understood and enjoyed by those who have sufficient mathematical knowledge and training. After experiencing the power of mathematics in solving physical and tangible real world problems, I feel that the applicability of mathematics as a tool to explain and describe the underlying mechanisms of the physical world is also a kind of beauty of mathematics. This fascinates me to think back to the age of Newton when mathematicians and physicists were starting to describe the complex physical world by mathematics and equations. In the past few decades after the advent of fast and powerful computational ability, abundant progress in applications of mathematics has been going on with incredible pace in areas of engineering, scientific computations, economics and finance, etc. A mathematician working in mathematical applications can gain more fun than a mere user of mathematics who knows only how to plug in formulas, because the former can enjoy much more the beauty of mathematics by its rigorous abstract interconnections as well as the amazing applicability and power of the underlying mathematics tools.

On top of the island of mathematical abstractness where it requires substantial knowledge and training, the author is trying to share his experience with non-mathematician outsiders so that they can also enjoy the power and applications of mathematics.