J. Indian Inst. Sci.
A Multidisciplinary Reviews Journal
ISSN: 0970-4140 Coden-JIISAD

EDITOR'S DESK

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In the summer of 2019, I happened to be in Princeton. A natural stop for a visitor in this charming university town is the Albert Einstein house at 112 Mercer Street, where Einstein had lived for nearly two decades. Although it is not maintained as a museum (as per Einstein's wish, I read) and not open to the public (someone lives there), it felt good to stand in front of the house and take a selfie.

Yet another stop in this town is the Institute for Advanced Studies where Einstein had worked. The office he had used is still intact. We, as curious visitors, stepped in to take a look. Soon, a lady came running to tell us that it is not open for the public as it is used as an office by a professor. As we came out of the room into the hallway, we found an elderly person walking in toward that historic office. I thought that he must be Prof. Robert Langlands. I knew of him as I had read about Langlands Program in Edward Frenkel's popular mathematics book, *Love and Math: the Heart of Hidden Reality*. Another thing that flashed in my mind at that moment was what Frenkel (now a professor of mathematics at Berkeley) says in his book: mathematics is one subject that many are not ashamed to admit that they are not good at it. Some are even scared at the thought of learning mathematics. School mathematics, which is mostly arithmetic and some trigonometry and calculus, is enough for most people to revere mathematics and place it on a high pedestal. What would they say if they are exposed to abstract notions of this queen of sciences (and some would call it, the servant of sciences as it is an essential tool to understand almost any science)? For example, how do non-mathematicians respond when they are introduced to the Langlands Program? Frenkel compares it with the Grand Unified Theory (GUT) of particle physics and calls the Langlands program, the GUT of mathematics.

With some effort, GUT of particle physics can be explained to non-mathematicians the general public. But can the Langlands program, said to build bridges between apparently disparate topics, be explained in simplistic ways without losing its essence?

The theme of this issue (number theory and representation theory) is related to the Langlands program because it conjectures a web of tight connections among these two theories and others. Number theory is well known in popular culture, thanks partly to the Hardy-Ramanujan episode, Fermat's last theorem, Goldbach conjecture (which finds a mention in high-school texts), and other famous anecdotes. Representation theory, on the other hand, is less familiar. At the risk of making a mathematician a little uncomfortable, one could say that the representation theory transforms problems in abstract algebra to those in linear algebra, the latter being used widely by engineers and physicists.

But any good attempt at defining representation theory precisely will necessitate defining at least two dozen other mathematical concepts. It is like the old-fashioned way a novice looks for the meaning of a difficult word in an English-to-English dictionary. You come across more unfamiliar words in the meaning of the word you begin with. That is perhaps one difficulty with the language of mathematics. One must study it from the basics and build on it to master a topic. As Galileo famously said:

> *[The universe] cannot be read until we have learnt the language and become familiar with the characters in which it is written. It is written in mathematical language, and the letters are triangles, circles and other geometrical figures, without which means it is humanly impossible to comprehend a single word. (Opere Il Saggiatore, p. 171)]*

Mathematics and mathematical language have advanced by leaps and bounds since Galileo's time. Consequently, it has become quite inaccessible to non-mathematicians as it requires them to comprehend the purport of theorems and arguments written in the mathematical language of symbols, equations, and terms. Fields, groups, modules, rings, etc., have precise definitions in mathematics. To define anyone of these

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mathematically, one would need to introduce and define many concepts and terms.

Specific terms with precise meanings—jargon as some may call it—exist in all subjects. Therefore, this journal uses wide margins to define such terms to facilitate the multidisciplinary readership. When it comes to articles in this issue, I feel that margins will be filled and there will not be any room left if one defines all such terms. Perhaps that is why the margins are left untouched in the articles of this issue. So, to those readers who want to scribble a proof or two, there is plenty of margin space!

We also have a "starter" article to introduce the theme to educated readers with noexpertise in this. I convey my gratitude to Prof. Sujatha Ramadorai (University of British Columbia) who graciously agreed and wrote the article at a short notice. It is written in the true mathematical language for mathematicians and provides readers with the background required to follow the other articles in this issue. The guest editorial also sheds light on the articles contained in this issue. I thank the four guest editors who contributed their time to this issue. Prof. Kaushal Verma, the Executive Editor of this journal and a mathematician himself, suggested the theme and coordinated it from the beginning to its completion. His guidance for this issue (and the next) is gratefully acknowledged. The last time we had a mathematics theme was in 2011. We hope to have more themes in mathematics in the coming years. Mathematics may not be accessible to all of us—much like Einstein's office in the Institute for Advanced Study at Princeton. But like the great physicist's office, we can be rest assured that it is being put to good use.

Publisher's Note

Published online: 7 October 2022