# A History of Pi

## *By* ***Petr Beckmann, Dorset Press, New York, 1971, 202 pp***

# The Joy of π

## *By* ***Blatner, Viking, Canada, 1997, xiii + 130 pp***

In the history of mathematics, there is perhaps no number that has captured and fired the imagination of both professional and amateur mathematicians more than the famous number which is now denoted by the 16th letter of the Greek alphabet, $\pi$ - transliterated as *pi* and pronounced as "pie" (as in "apple pie"). As almost all school kids will know, it is the constant obtained by dividing the length of the circumference of any given circle by the length of its diameter. Ask them what it is and you will very likely get the reply: 22/7. Ask any adult about $\pi$ and their memories will fade into a long forgotten world of lines and circles.

The two books reviewed here uncover the human efforts made throughout the world and throughout the ages in understanding the nature of $\pi$. To understand why so many people have been fascinated, if not obsessed, by $\pi$, one has to realise that it crops up, implicitly or explicitly, almost everywhere in calculus (which is the fundamental tool in applications of mathematics) and, of course, inevitably in probability and statistics (which are indispensable in the analysis of data and information).

Even before the advent of calculus in the 17th Century, both practical and theoretical mathematicians since 2000 B.C. have attempted to give better and better approximations of $\pi$. Better not just in the numerical sense, but also better in a deeper mathematical sense. It is as if discovering the exact value of $\pi$ will lead to the unravelling of mysteries in some other areas of mathematics. For some mystical reason, the occurrence of $\pi$ in a mathematical formula will not fail to evoke a feeling of awe and wonder in a mathematician. For number crunchers, churning out the digits of $\pi$ by a more effective method provides immense satisfaction.

The earliest records extant show that many of the earliest civilizations approximated $\pi$: the Babylonians did it, and so did the ancient Egyptians, Sumerians, Chinese, Greeks and Indians. Surprisingly, no record has been found that the ancient Mayas did it, but then, much of their records had already been systematically destroyed by the conquistadores. The Greek mathematician Archimedes (around 3rd Century B.C.) is usually credited with the first rigorous geometrical method that can approximate $\pi$ to any degree of accuracy (at least in principle). Many of the later efforts were computational implementations of his method. In his contributions to mathematics, it is no exaggeration to say that we find in Archimedes a modern mind in an ancient age.

After Archimedes, there are numerous illustrious names in science and mathematics connected, though not necessarily in a linear order, with the mystique of $\pi$ in one way or another: Appolonius, Ptolemy, Chung Hing (Zhang Heng), Liu Hui, Tsu Chung-Chi (Zu Chongzhi), Aryabhatta, Brahmagupta, Fibonacci, Al-Kashi, Viete, van Ceulen, Snellius, Huygens, Wallis, Brouncker, Newton, Gregory, Leibniz, Machin, de Lagny, Euler, Lambert, Legendre, Shanks, Lindemann among others. Even the non-human computers are judged according to their ability to compute thousands upon thousands of digits of $\pi$ speedily and accurately. It also seemed to be mandatory for the increasingly more powerful computers released since 1949 to prove their metier by improving on the record number of digits of $\pi$ set by their predecessors. Both humans and machines are unable to flee from the spell cast by $\pi$.

The major and minor protagonists in the drama of $\pi$ are featured in the book by Beckman together with his own running commentary on the social and political backgrounds of their epochs. He also has stories and anecdotes to tell about all those people who had something to do with $\pi$. However, conspicuously missing from his account are the contributions to the treasure box of $\pi$ by the legendary (almost mystical) Ramanujan and other mathematicians since the nineteen seventies. This book is very readable and entertaining with a flavour different from that in the usual English books on mathematics. Incidentally, Beckmann is a professor of electrical engineering who emigrated to the United States from Czechoslovakia in the sixties.

Blatner's little book gives a more concise account and contains more recent updates, including a remarkable infinite series by Simon Plouffe, Peter Borwein and Jonathan Borwein that allows you to calculate the nth digit in the hexadecimal (base 16) representation of $\pi$ without the need to calculate the preceding digits. The second book is different in style from the first, and takes on the form of a mathematical scrap book with cut and paste quotations and mathematical snippets generously scattered throughout the pages. Unfortunately, a number of pages have words printed on a background of patterns and motifs, making it visually strenuous to read the text. Both books contain numerous mnemonics for the digits of $\pi$ and mention the laughable, if not absurd, episode of human egotism and bureaucratic bumbling in an attempt to legislate the value of $\pi$.

Blatner maintains a website at http://www.joyofpi.com which contains many links offering both serious information about $\pi$ as well as interesting trivia on anything remotely related to $\pi$. It shows that an ancient number can still be relevant in modern times and generate much fun and entertainment. If you are looking for serious stuff, especially the real research stuff, there is a source book on the original (ancient and modern) papers that have been written on $\pi$. It is simply called *Pi: a source book* (Second Edition) and is compiled by Lennert Berggren, Peter Borwein and Jonathan Borwein and published by Springer-Verlag.

If you need to answer the million-dollar question such as "What is the one millionth digit in the decimal representation of $\pi$?", you will know where to find the answer.

*Reviewed by*

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