BOOK REVIEWS

Amar Sodhi

Mrs. Perkins's Electric Quilt: And Other Intriguing Stories of Mathematical Physics
Reviewed by Nora Franzova, Langara College, Vancouver, BC

In the opening paragraph of chapter one the author states:

*The central thesis of this book is that physics needs mathematics, but the converse is often true too.*

From that point on, Physics and Math play a sort of a game in which they pass a ball to each other, each time trying a more challenging shot to see if the other player can catch it and then reciprocate. Nahin supports each of the players with equal cheer. The game is not about who (Physics or Math) is better or more important; it is about playing a great game.

This game keeps physics enthusiasts and math lovers reading on. The strongest feature of the book is undoubtedly the enthusiasm of the author himself. His passion for the subjects is the key force behind all the interesting math problems that he suddenly turns into physics problems and vice versa. Immediately (in the preface of the book) Newton's second law becomes the main part of the proof of the oh so well-known limit, \( \lim_{n \to \infty} \left(1 + \frac{x}{n}\right)^n = e^x \).

A convincing proof of this limit is rare in an introductory calculus course.

There are 19 chapters in the book — but the author calls them “discussions” and they definitely are that. The author invites you to sit down, grab a piece of paper and compute things first alone and then with him. Nahin spices up every step with a joke or a piece of history, personal comment or reminiscence, and in doing so one learns much about his jobs, and his personal path through math and physics. Each chapter ends with “Notes and References”. These are worth reading in their own right as it is not just a traditional list of references, but something that leads to another discussion, involving equations and solutions, of the author with his audience.

Of course we cannot forget the Challenge Problems (the reviewer is still working on many of them, resisting the temptation to peek into the back of the book, where full solutions are included). These problems range from computing integrals, through modelling random walks. In the preface we are warned that the book is not the kind where an amazing problem is given a short succinct elegant two-line solution. The solutions are the realistic kind — one needs a good supply of paper, a pencil and sometimes even a computer facility like MATLAB. Nevertheless, the solutions do not send you to bed with the feeling that a question is done and finished with, but more with a need to further discuss or maybe just argue with the author a bit about things.
Even though the author stipulates that his “intended audience includes
students of mathematical physics, starting with very bright high school se-
niors who have taken AP calculus and physics”, the reviewer believes that
some of the computational steps require a higher mathematical maturity to
be fully enjoyed. Topics explore Newtonian gravity, lots of electrical circuits,
ballistics, then more gravity, random walks, and even big noise.

Newtonian gravity starts with a non-traditional home experiment of
measuring gravity with a stopwatch, a rubber ball, and a yardstick (and of
course a formula). The reviewer repeated the author’s very successful exper-
iment in her kitchen (with a tiled floor) and got a result not as good as the
author, but still pretty close. In another chapter about gravity and Newton
we compute how much energy it would take to disassemble a planet of the
Earth’s size. It is definitely much more than movies want us to believe. Yes,
the author discusses movies, poems, and songs throughout the book. In the
discussion called Really Long Falls, we learn how long it would take for the
Earth to fall into the Sun, which is immediately followed by a full analysis of
the journey of fallen angels (from Heaven to Hell). Once we get this far into
Heaven we get the challenge of calculating the mass of the Moon.

Extremely tempting integrals arise in the Zeta Function and Physics dis-
cussion, which in its references and notes section also includes lyrics of a
mathematically spiced song. The discussion about Ballistics With and With-
out Air Drag naturally involves cannons, but also includes baseball studies.

Probability is taken on in three discussions with titles: Random Walks,
Two More Random Walks, and One Last Random Walk. Topics start with
mosquitoes and finish with electrical circuits. A Monte Carlo simulation is
presented with its MATLAB code along with interesting computation. More
probability takes us to an island of cannibal mathematicians in the Nearest
Neighbors discussion. Reasons for finding an average distance to a nearest
neighbor are easy to justify, the computation is elegant, but the result is
quite surprising and convincingly supported by a Monte Carlo method.

Naturally, there has to be a discussion about an electric quilt. The
story starts with a real square quilt cutting puzzle of Sam Loyd from 1907,
but then the quest continues in finding the perfect squared square. Once the
quilt turns electric, things are easier to see — mathematically and physically
speaking.

There is much more to explore and capture in the book since pages are
quilted with a fine thread of jokes and notes, personal comments that each
reader needs to pick out on their own.

And as the ball is being tossed between Math and Physics throughout
this book, we can only thank the author for helping us understand more of
this game. Often we tell our students that to be able to do physics they have
to learn “all this math”, but this book suggests that the converse is also true:
to be able to do “all this math”, we need to be able to understand and use
“all this physics”.

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A Taste of Mathematics Volume VIII, Problems for Mathematics Leagues III
By Peter I. Booth, John Grant McLoughlin, and Bruce L. R. Shawyer
Published by the Canadian Mathematical Society, 2008
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Reviewed by Nancy Clarke, Acadia University, Wolfville, NS

Problems for Mathematics Leagues III, the eighth volume in the ATOM series (A Taste of Mathematics) published by the Canadian Mathematical Society, is a collection of problems created for the 2003-2004 and 2004-2005 seasons of the Newfoundland and Labrador Senior Mathematics League. The league was founded by one of the authors, Bruce Shawyer, more than 20 years ago in St. John's and has since expanded throughout the province. The league was also the inspiration for a similar league which has been running in Nova Scotia in recent years.

The authors have considerable experience and skill with mathematical problem solving and, in particular, with helping to develop such skills in students. For example, Peter Booth has been a member of the CMS's Mathematical Olympiad Committee and Bruce Shawyer has served as a head coach of Canada's International Mathematical Olympiad team. Interestingly, it was during a competition of the Newfoundland Math League that the reviewer first met John Grant McLoughlin and began to develop her own "taste for mathematics".

The first four games in a season of the Newfoundland Math League are held regionally, with the highest ranked teams competing in a provincial championship game. The problems in this book are organized according to game. Each of the five games per season include ten "regular" problems, ordered in terms of increasing difficulty, followed by a special relay problem at the end. The relay problem has four parts and is constructed so that each part depends on the answer to the previous one.

This is a wonderful book, with a variety of problems coming from areas of mathematics such as combinatorics, number theory and geometry. Complete solutions to the first ten problems per game are included. Answers, without solutions, are given for the relay problems. Multiple solutions to problems are sometimes included. This is especially instructive as it helps illustrate the connections that exist between the various mathematical ideas presented. This variety of analyses also shows students that different approaches to a problem can all lead to correct solutions.

Problems for Mathematics Leagues III is a book that makes problem solving accessible, and illustrates that it can be both rewarding and enjoyable. It is a valuable resource for teachers and a great adventure for keen students.