lem that played an important role in the creation of modern science: the void.

The first part presents young Mersenne’s efforts to build his network of acquaintances and correspondents. Each of his friends, Peiresc, Gassendi, and Descartes, enables him to make contact with further savants. Through Peiresc, he is introduced to musicians like Jacques Mauduit, an actor of Bafi’s academy, to Jean Titelouze, an organ player from Rouen, and to Italian connoisseurs of ancient music, like Giovanni Battista Doni in Florence or Jacques Gaffarel in Venice. It is especially with Descartes, after he left for the Netherlands, that Mersenne achieved his apprenticeship as an “intelligencer”. He aimed to be the only link between the philosopher and his homeland. This part of the book also gives the reader a flavor of the scientific atmosphere in Paris when Mersenne arrived there in 1619. The monk took part in the heated debates on Paracelsian alchemy, and on the philosophy of the Rosecrucians. In a commentary on Genesis (1623), he condemns all kinds of heresy in the strongest terms. Maury interprets Mersenne’s attacks against the English Paracelsian Robert Fludd as a first sign of Mersenne’s future orientation toward science put in the service of religion.

The second part, focusing on the year 1634, shows Mersenne’s network developing, especially in southwest France, where he discussed the problems of the fall of a body or of the pendulum with correspondents like the lawyer Jean Trichet and the physicians Jean Rey and Christophe de Villiers. Maury’s book gives a lively account of the outburst of scientific research during the first part of the seventeenth century, and we encounter a number of lesser-known actors whose biographies are fortunately provided by Sylvie Taussig in an appendix. In two of the five treatises he wrote in 1634, Questions inoyues and Questions théologiques, physiques, etc., Mersenne extended the method of questioning he had developed with correspondents like Descartes, Van Helmont, and Beeckman. He was looking for answers to unsolved problems from his readers. One year after Galileo’s condemnation, Mersenne published the Mechaniques de Galilee, Florentin and significantly contributed to the circulation of Galileo’s ideas, especially in France. Also in 1634, Tommaso Campanella escaped from the Roman Inquisition’s prison and came to Paris. Maury is excellent in characterizing the relations between the two men, and especially Mersenne’s disappointment when he finally met Campanella. In his prison, Campanella had hardly been able to come to grips with the quick advancement of science. Mersenne saw him as a man of the past, while he himself was gathering in his circle the most modern representatives of science and especially of mathematics: Etienne Pascal, Gilles Personne de Roberval, Claude Hardy, Claude Mydorge, etc. He was thus a forerunner of the modern academy.

The third part is a study of Mersenne’s contributions to a well-known problem in the history of science, the problem of the void: is it possible for any part of the universe to be absolutely empty? The accepted view at that time was that there could be no such thing, because of “nature’s abhorrence of a vacuum”. Blaise Pascal confirmed the existence of a vacuum in 1648, thus bringing, in the author’s eyes, the new science born with Galileo to maturity. Mersenne, traveling in Italy in 1644, brought news of Torricelli’s barometric experiment to France. He served as an intermediary between Italian experimenters, like Gasparo Berti and Emmanuel Maignan in Rome, for instance, and his French correspondents, especially the engineer Pierre Petit, who was able to repeat Torricelli’s experiment with Etienne and Blaise Pascal in Rouen. It was left to the young Pascal to give an interpretation of the experiment. In 1647, he set a glass tube sealed at one end in a bowl of mercury and showed that the space not occupied by the rising liquid was empty. He then designed his famous experiment at Puy-de-Dôme, in which he showed that, on a muntaintop, the height of the column of mercury decreases due to the pressure of the air outside. This story is well known. Maury’s narrative takes in a number of lesser known actors, for instance Valeriano Magni experimenting in Poland, and describes in detail the contacts between the different actors, their travels, encounters, academies, written reports, and letters exchanged.

It is a pity that Maury, who excels in giving an accurate picture of seventeenth-century science as a collective enterprise, has not extended this concept to modern history of science. He hardly makes any use of the important secondary bibliography; he does not even make the slightest reference to Armand Beaulieu, the editor of the last volumes of Mersenne’s correspondence and also the author of a biography of Mersenne. Professional historians will be upset by the lack of references, some unfortunate references to “the dark middle ages”, and the ignoring of their own work. But this book will be read with profit by all those whose interest in seventeenth-century science is new and who want to know how modern science took its present form.

Jean-Pierre Maury, who died in 2001, was not able to finish his book; it has been edited by Sylvie Taussig, a philosopher and Gassendi scholar. She added footnotes and valuable appendices to the core of the work: a chronology, short biographies of all the actors of Maury’s story, a bibliography of Mersenne’s writings, and a substantial afterword putting emphasis on the links between science and religion in Mersenne’s work and in the seventeenth century.

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Irresistible Integrals: Symbolics, Analysis and Experiments in the Evaluation of Integrals
by George Boros and Victor H. Moll

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REVIEWED BY J. J. FONCANNON

The physicist Richard Feynman once claimed that he acquired his initial professional reputation not as a physicist, but as a redoubtable evaluator of integrals. A colleague would
approach him with a knotty integral discovered during the investigation of some physical problem. A couple of hours later Feynman would return the integral, fully evaluated. The donor, typically, would react with bemused reverence. Feynman, who had a mischievous nature, was secretive about how he accomplished what he did, but he later revealed that he had developed an armamentarium of techniques. Prominent among these was differentiation of the integral with respect to a parameter to produce a differential equation, which he subsequently solved. Furthermore, Feynman had acquired an intuitive feel for how to introduce a parameter artificially when the original integral lacked one, and then he would work with the modified integral. This approach, of course, constitutes a subcase of a widely recognized mathematical ploy: if you cannot solve the original problem, solve a more general problem. Differentiation with respect to a parameter is a simple technique the authors of the present book use often. Other techniques they use are to generate a recurrence for the integral and then solve the recurrence, or to employ partial fractions. Many current victories in the evaluation of challenging integrals have been obtained through the use of modern mathematical developments, like group representation theory or arguments based on combinatorial reasoning. However, these accomplishments lie far beyond the scope of the present book.

Like all good things, skill at the evaluation of integrals increases with experience, and expertise does not depend, necessarily, on one's being a practicing mathematician. One of the most skillful practitioners I have ever known was an aeronautical engineer, who was a wizard at evaluating integrals around branch points in the complex plane.

The present book is replete with riches. However, in my view, it suffers from two major shortcomings. One is in the paucity of material from the theory of special functions. The other is the lack of function-theoretical methods. Most integrals arising in mathematical physics call for the special functions of mathematical physics, either in the definition of the integral or in the evaluation of the integral: Bessel functions, hypergeometric functions, the error function, the exponential integral, sine and cosine integrals, etc. Hypergeometric functions are mentioned in the present book, but not presented in enough detail to give the reader a feel for them. All mathematical software has the capability of handling such functions, and I find it strange that the authors, who rely heavily on Mathematica in their exposition, have declined to define and provide the properties of such functions. They utilize only the gamma and beta functions and some related functions.

I fully understand the authors' reason for not including function-theoretic arguments or more material from special functions, namely, the lack of experience among the undergraduates for whom the book was primarily written. But the authors have ended up with a book that will be of only provisional appeal to its chosen audience, and it certainly will not provide enough mathematical substance to interest those who will go on to become practicing physicists or mathematicians. As a consequence the book has a fussy, ad hoc, chase-your-own-tail quality, and too rapidly degenerates into a bricolage of formulas. I suspect that some of the material was included not because the authors considered it truly germane, but because they couldn't stop. (How well I understand this affliction.)

All the integrals the authors treat that are of the form

\[ \int_0^\infty x^a \, (a + x)^b \, (b + x)^y \, dx, \]

and the investigation of these comprises a substantial part of the text, are actually hypergeometric functions\(^1\), \(2F_1\)'s. To speak a little more of these functions would have saved countless pages of busywork. Much of the rigmarole in the book could have been avoided, leaving more room for sophisticated matters.

As a number of current texts have shown, the tyro can rapidly be given the knowledge necessary to apply the residue theorem—precisely what one needs to evaluate integrals. The book of Seaborn\(^2\) does this brilliantly, in a scant 30 pages. A student who can conceptualize power series (and the authors rely on these heavily) can deal with the rudiments of complex analysis. The authors talk at great length about the evaluation of

\[ L_n(a) = \int_0^\infty \frac{dx}{(x^2 + 2ax + 1)^{n+1}}, \]

\[ m = 0, 1, 2, \ldots \]

As previously pointed out, these are hypergeometric functions, but a more elegant way of proceeding is to evaluate by residues the integral

\[ \int_C \frac{x^m \, dx}{(x^2 + 2ax + 1)^{n+1}} \]

along a Mellin contour \(C\) —a circle with radius \(R\) centered at \((0)\) cut along the positive real axis, \(R \to \infty\)—and then to let \(s \to \infty\).

In Chapter 2, the authors show that \(L_n(a)\) satisfies the recursion

\[ L_n(a) = -\frac{2m - 1}{2m(1 - a^2)} \, L_{m-1}(a) \]

but they state that obtaining a precise form for \(L_n(a)\) from this relationship "seems to be difficult." No—it is easy. The equation is a linear first-order non-homogeneous difference equation and can be solved by the standard technique: obtain the solution of the related homogeneous equation, and then a particular solution by variation of parameters. The authors should have included this procedure in their introductory material.

A minor misgiving I have is the emphasis on "conjecturing closed formulas." The authors are devoted to this arithmancy, and they invoke it repeatedly. Typically, they will compute several selected values of a number-theoretic sequence \(x_n\) and, providing hints, ask the reader to conjecture a general formula for \(x_n\). This approach reminds me of the hoary query I was posed on moving to what is now my hometown: What is the next entry in the sequence

\[ 30, 34, 40, 46, 52, 60, 63, \ldots \]