Book Reviews

Gaṇitasārakaumudī: The Moonlight of the Essence of Mathematics by Ṭhakkura Pherū
Edited with Introduction, Translation, and Mathematical Commentary by SaKHYa.
New Delhi (Manohar). 2009. ISBN 978-81-7304-809-8. viii + 278 pp. No price given.

The present volume is an edition, with English translation and commentary, of a
mathematical text, the *Gaṇitasārakaumudī* (literally, *The Moonlight of the Essence of
Mathematics*), composed in Delhi, India by Ṭhakkura Pherū in the first quarter of the
14th century of the common era.

The author-acronym SaKHYa combines the first letters of the surnames of the four
scholars who prepared the volume, namely Sreeramula Rajeswara Sarma, Takanori
Kusuba, Takao Hayashi, and Michio Yano; adding the a's generates the Sanskrit word
sakhya, which means "friendship." The acronym thus celebrates the long friendship and
productive collaboration between the four scholars. The latter three of the four are based
in Kyoto, Japan, currently the largest center for the study of the exact sciences in India,
where they hold weekly meetings to study primary Sanskrit sources on mathematics and
astronomy.

The fourth scholar, S.R. Sarma, was invited to join the group when he spent a semester in
Kyoto in 2002. During that time, over a period of six months, the group studied the
Gaṇitasārakaumudī and prepared an English translation and a draft mathematical com-
mentary. The work was subsequently prepared for publication. Common to the four schol-
ars is that they each worked closely with the late David Pingree of Brown University, to
whom the volume is dedicated.

Ṭhakkura Pherū, the author of the *Gaṇitasārakaumudī*, hailed from Kannāṇā (or
Kannāṇapura), the modern Kaliyana in Haryana state, which was an important Jain pil-
grimage site in the 13th and 14th centuries CE. We have little information about his early
life, but his earliest dated work was composed in 1291 CE. Since the last chronological ref-
erence to him dates from 1323 CE, he was likely born around 1270 CE. He was born into the
Śrīmāla caste and belonged to the Kharatara sect of Jainism. Ṭhakkura Pherū was a well
educated man, having studied Jain religious texts, as well as architecture, mathematics,
astronomy, and astrology. He furthermore had, as evidenced by his writings (see below),
knowledge of the gem trade, perfumery, and minting and money exchange. His family
appears to have been involved in banking and the trade of luxury goods. In fact, the group
of Jains that Ṭhakkura Pherū belonged to were known for their expertise in minting and
banking. This expertise was drawn upon by the Muslim rulers of the Delhi Sultanate
and the Jains therefore enjoyed good relations with the court. As a result, the Jains became
mediators between the Islamic and Sanskritic knowledge systems found within the
Sultanate. Ṭhakkura Pherū was such a mediator. Due to his family background, he easily
found employment in the treasury of the Delhi Sultanate. By 1318 CE he occupied a high-
ranking position in the Sultanate's mint. In a work entitled the *Dravyaparīkṣā* (see below),
Ṭhakkura Pherū describes the name, provenance, weight, metal content, and exchange

value of about 260 types of coins issued by various kingdoms in northern India in the 13th and early 14th centuries CE.

Thakkura Pherū was brought to the attention of the scholarly world by two Indian scholars, Agar Chand Nahata and Bhanwar Lal Nahata, who in 1946 discovered a manuscript containing a collection of seven of his works in Calcutta. In addition to the undated *Gaṇitasārakaumudī*, the manuscript contained the *Kharataragaccha-yugap-radhāna-catuḥpadikā*, a eulogy for the spiritual leaders of the Jain Kharatara sect dated to 1291 CE; the *Ratnaparīkṣā*, a work on gemology dated to 1315 CE; the *Jyotiṣasāra*, a work on astronomy and astrology dated to 1315 CE; the *Vāstusāra*, a work on architecture and iconography dated to 1315 CE; the *Dravyaparīkṣā*, a work on assay and exchange of coins dated to 1318 CE; and the *Dhātūtpatti*, an undated work on metallurgy. All of these seven works are composed in the vernacular Apabhraṃśa rather than in Sanskrit, the scholarly language of India. With the exception of the *Kharataragaccha-yugapradhāna-catuḥpadikā*, these works of Thakkura Pherū deal with scientific and technical subjects, many relevant to his work for the Delhi Sultanate. The Nahatas eventually published these seven texts in 1961, their edition being based on the single manuscript discovered by them.

The *Gaṇitasārakaumudī* is an important mathematical treatise. It is the first fully-fledged mathematical text written in Apabhraṃśa, and it expands on the mathematical topics traditionally covered in Sanskrit texts on mathematics. In particular, it includes a variety of everyday topics with examples. According to his own testimony, Thakkura Pherū relied on material by past and contemporary teachers of mathematics, as well as his own work. Among the works of past teachers, the main influences on Thakkura Pherū appear to be the *Gaṇitasārasaṅgraha* of Mahāvīra (ninth century CE) and especially the *Pāṭīgaṇita* and the *Triśatikā* of Śrīdhara (eight or ninth century CE).

The *Gaṇitasārakaumudī* consists of five chapters, namely:

1. Twenty-five Fundamental Operations.
2. Eight Classes of Reduction of Fractions.
3. Eight Types of Procedures.
4. Four Special Topics.
5. Quintet of Topics.

The first three chapters contain material from mathematical treatises predating Thakkura Pherū and are structured like a traditional Sanskrit mathematical work, whereas his own work and the work of his contemporaries is found in the fourth and fifth chapters, the structure of which is much looser. Rather than producing a conventional mathematical treatise, Thakkura Pherū composed a more practical manual that would be useful for professionals, including bankers and masons. The text also contains recreational problems. One of the most interesting topics dealt with in the work is found in Chapter 4, where Thakkura Pherū gives procedures for constructing magic squares. As noted by SaKHYa, this is the first discussion of magic squares in an Indian mathematical text.

The present edition, translation, and study of the *Gaṇitasārakaumudī* is divided into four parts: an introduction, the edition of the text, an English translation of the text, and a mathematical commentary by SaKHYa. This is augmented by a number of appendices. The introduction gives us the known information about Thakkura Pherū, his times, and his works, as well as an informative overview of the contents of the *Gaṇitasārakaumudī*.

The edition of the text of the *Gaṇitasārakaumudī* is based on that of the Nahatas referred to above. The manuscript discovered by the Nahatas is the only known manuscript of the text, but, unfortunately, its whereabouts are no longer known. SaKHYa therefore only had the Nahatas' edition available when producing their book, and, as a result, what we have is a revised version of the Nahatas' edition. The Nahatas' text has been emended, when deemed necessary for mathematical or other reasons, but the original readings have been preserved in footnotes. Furthermore, words have been separated independently of phonetic changes, which makes it easier to find a word in the text.

The English translation presented in Part Three is literal and precise. The mathematical commentary in Part Four elaborates on the translation, contextualizing and explaining it. Finally, the appendices provide a concordance between the *Gaṇitasārakaumudī* and other works, a glossary-index to the text, and other useful tools.

Overall, the volume is a wonderful contribution to the field of the history of mathematics in India. The text is carefully edited, the translation precise, and the mathematical commentary solid and informative. Moreover, the introduction puts the material in the appropriate historical context. As a result, the volume will be of value both to the specialist, who will want to consult the original text, as well as to a more casual reader, looking to learn more about mathematics in India in the 14th century. It is hoped that SaKHYa will continue their good work on Indian mathematics and that their collaboration will produce more volumes like the present one.

Toke L. Knudsen
Department of Mathematics, Computer Science, and Statistics,
SUNY Oneonta, 108 Ravine Parkway,
Oneonta, NY 13820, USA
E-mail address: toke.knudsen@oneonta.edu

La construction tractionnelle des équations différentielles
By D. Tournès. Paris (Albert Blanchard). 2009. ISBN: 978-2-85367-247-4. viii, 406 pp. No price given.

Before the invention of computers and the development of numerical analysis, scientists and engineers conceived, designed and built various mechanical devices to speed up long, complex calculations. In recent years the history of these instruments has been the subject matter of different works, among which Dominique Tournès's *La construction tractionnelle des équations différentielles* certainly stands out. Tournès's book focuses on the integration of differential equations by tractional motion. This was a method of integration first used in the 1690s, forgotten in the second part of the eighteenth century, rediscovered in the nineteenth century and then forgotten again after 1950. This long story is interesting at least for two reasons. First, it shows the complexity of the interrelations between analysis, geometry, mechanics, and technology. Secondly, it clearly exemplifies that historical developments in mathematics often cannot be reduced to a mere accumulation of procedures, theorems, and findings.