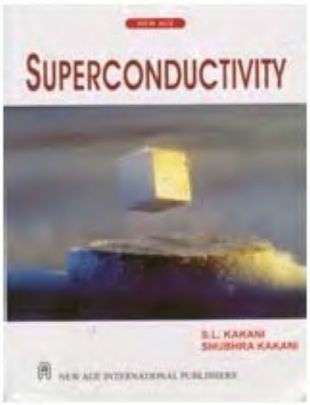

Superconductivity. L. Kakani and Shubhra Kakani. New Age International (P) Limited, 4835/24, Ansari Road, Daryaganj, New Delhi 110 002. 2007. 666 pp. Price: Rs 295.

After the discovery of superconductivity in 1911, research in the field followed a single pattern of finding out the transition temperature (T_c) at which different materials turn superconductors. These were mainly pure metals. Afterwards, the search was with binary alloys and then compounds. At the same time theoretical researches for explaining superconductivity also developed. In 1953, superconductivity was reported in intermetallic alloy vanadium silicon (V_3Si) at 17 K. This discovery opened up the whole era of the so-called A15 superconductors. In 1954, Matthias and collaborators discovered niobium–tin (Nb_3Sn) superconductor at 18.1 K. The first 50 years of research on superconductivity were marked by intense academic endeavour to understand this new state of matter. Applied or engineering superconductivity started only from the early 1960s with the introduction of high field and high current superconductors using Nb_3Sn alloy by Kunzler and colleagues. In 1973, the last member of the A15 superconductor family, an alloy of niobium and germanium (Nb_3Ge) reached the highest T_c (23.2 K). This remained the highest critical temperature for many years.

In 1986, Bednorz and Müller reported superconductivity near 35 K in materials based on a mixture of copper oxides and rare earth metals. This discovery opened a new approach to the study of superconductivity. These materials are easy to fabricate, have high critical temperatures with strong theoretical basis and their discovery had serious technological ramifications. The race for higher T_c materials started immediately. The field of high-T_c superconductivity has triggered a wide area of research attracting hundreds of scientists throughout the globe searching passionately for the next breakthrough, either in performance (material) or in understanding (mechanism). While no significant advancement in terms of T_c of superconductors has been achieved in recent years, discoveries in other areas of no less importance have been made. The beginning of the 21st century saw superconductor applications reaching newer heights.

The monograph under review explains the fascinating subject of superconductivity in an easily understandable language. It reviews the developments in the topic covering both experimental results and present theoretical understanding and highlights new areas of application. The monograph has been written by two eminent physicists, who are leading researchers in this field for more than 30 years. Perhaps the basic purpose is to familiarize the advanced students with these complex phenomena and to put before them the new discoveries and state-of-the-art of the problem in vigorous pursuit of knowledge in this field. They review the theoretical concepts and experimental status of the topic in 10 chapters (several quite brief), with emphasis on its relation to high-T_c superconductivity. Tables of useful numerical data are included in the text. Although each chapter is supplemented by an extensive bibliography containing references of more than 1500 publications, a few of them (e.g. ref. 52, p. 27; refs 6–8, p. 80, etc.) need to be corrected. There is description of a few unnecessary terms, whereas some useful terms have been omitted in the glossary appended at the end of the book.

The monograph is broadly divided into three parts – part 1 is on low-temperature superconductivity covering the first five chapters; part 2 covers high-T_c superconductivity in the next three chapters, and part 3 is on emerging superconductors (chapter 9) and the last chapter is devoted to applications of superconductivity. To start with, in the first chapter, the authors dwell on the basics of superconductivity and historical perspective to the evolution of the topic. It is worthwhile to mention here that on p. 7, the authors mentioned the two-fluid model, proposed by F. and H. London in 1934, but the proposal actually came from Gorter and Casimir (1934). The fact was rightly presented in describing the phenomenological theory in p. 95. Chapter 2 relates to the characteristic properties of the superconducting state. It includes electrical resistivity, perfect diamagnetism, critical magnetic field, thermodynamics of superconductors, isotope effect, flux quantization and tunnelling effects.

The theory of superconductivity has been dealt with in detail in four chapters – one each being devoted to phenomenological theory, microscopic theory, Hubbard model and Anderson lattice model, and theory of high-T_c superconductivity in cuprates. Extensive reviews of pairing mechanisms, theoretical status of fullerene superconductivity and some proposed novel mechanisms of high-T_c superconductivity are available. On the whole the coverage of the theoretical understanding of both low- and high-T_c superconductivity is reasonably adequate and interesting.

Chapter 6 is on high-T_c superconducting cuprates. It is the largest chapter of the monograph. The discussion on different families of cuprate superconductors, their crystal structures and electronic properties in relation to their maximum T_c-values is interesting.

In chapter 9, the authors describe emerging superconductors which cover a large spectrum of chemically different compounds ranging from intermetallic alloys (first discovered in early 1950s) to heavy fermion superconductors. They discuss in detail organic superconductors, superconductivity in fullerene and experimental discovery of photo-induced superconductors. It is unfortunate that they have overlooked the theoretical prediction of photo-induced superconductivity by Kumar and Sinha in 1968, although the first author of the book is a co-author of a number of publications of Sinha.

The last chapter relates to the applications of superconductivity. For addressing a number of global environmental problems, superconductivity is becoming increasingly accepted as a potential technology for the future. The book discusses elaborately all current applications and potential future applications of superconductors.

New entrants into research will find this monograph useful as a starting material in the emerging fields of high-T_c superconductivity. The book looks at the challenges and frontal problems through detailed reviews and extended articles covering fundamental properties and

theoretical understandings. But it lacks detailed discussion on the preparation of materials, their characterization and hands-on training on applications of superconductors. The organization of the book is ambiguous. Although Appendix 1 is placed at the end of the book, other Appendices (such that 2.1, 3.1, etc.) are inserted at the end of the respective chapters. The get-up of the book is acceptable, but it would have been better if typographical errors and mismatch of references with text were avoided. On p. 8 the initials of Bednorz and Müller have been interchanged.

The authors and the publisher have come out with this useful monograph, which will go a long way enriching our knowledge on both low- and high-T_c superconductivity and solve a long-felt need of a comprehensive treatise on the subject published in India.

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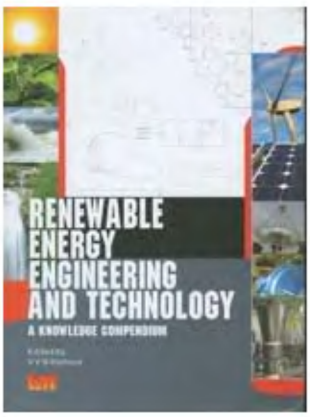

Renewable Energy Engineering and Technology: A Knowledge Compendium. V. V. N. Kishore (ed.). TERI Press, The Energy and Resource Institute, Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi 110 003. 2008. 925 pp. Price: Rs 2250.

This is a book long overdue and published just in time. It marks the coming of age of renewable energy technologies as a properly accredited technical discipline in India in its own right. We have an excellent textbook on the basics by Sukhatme, but all subsequent books have been neither textbooks nor reference books, but somewhere in between just by default. This book is a reference for graduate self-study and a handbook for practising engineers, as it is written primarily by researcher–designers and not by academic teachers. The first two introductory chapters should have been combined into one, with Chapter 2 as a section in Chapter 1, because it is too small to be a chapter by itself.

Many areas of science and technology contribute to renewable energy and thus there is a sizeable chapter on fundamentals after the introductory chapters. The section on photosynthesis should have also been transferred from the chapter on biomass to this chapter. This has been culled from many disciplines to provide a ready reference at hand. It is the reviewer's opinion that all the data along with dimensionless numbers (not included currently) should be grouped separately at the end as a reference appendix for ease of frequent use. There is considerable attention given to systems sizing and integration with balance of system components, which are usually 40% of the total cost, and are the weakest link in India. In 12 chapters, almost all the topics of renewable energy technology and engineering have been considered at reasonable levels of depth and sweep, but with different degrees of detail amongst the resources as applied.

Solar energy is covered in four chapters namely 'Resource', 'Photovoltaic', 'Thermal engineering' and 'Solar buildings'. The chapter on resource is adequate for application, but does not mention the latest estimating models for radiation, commonly discussed in research publications. An additional paragraph may have helped. Also, there should have been a reference to the WMO website, which includes data for 1300 stations around the world. The monthly mean global radiation isopleths of the Indian subcontinent could be useful for initial design stage only. The chapter on photovoltaics is exhaustive. From the point of view of applications, it has too much of details about manufacturing and too little about sizing. There should have been a fully solved example with multipliers for array and battery capacities for specified loss of load probability. A brief section on grid-interfaced solar PV systems and specific issues of building integrated PV would make the chapter more useful. The editor may like to consider this shift in emphasis for the second edition. Net energy generation over life time with current technology should be brought out explicitly, as this has been a major distracting factor in the past. The chapter on thermal engineering is easily the best, as this is the most mature technology. Integrated presentation of basics and application has worked out well for solar water heating, solar cooking and solar pond, but solar desalination, solar drying and solar power generation are missing altogether. This needs to be looked at, though there are other books available for such applications. Passive solar architecture with respect to different climatic zones of the country can be a perennial source of energy conservation without sacrificing adaptive comfort, which is healthier and takes into account body weight, age, clothing and acclimatization, as formulated by Fanger and later by Humphery and Nicol. A succinct and non-mathematical account is given for passive heating, and cooling for composite climate. The subject is too vast to be covered in a chapter, but a selective list of references would enable a student or designer to use various quantitative design techniques. These are available as computer-coded algorithms, which are gradually being used in India. However, the physics of these systems given in this chapter, is a must background for doing calculations with understanding.

Four chapters have been devoted to other sources of energy, which are more decisively site-specific, namely 'Wind energy', 'Small Hydro', 'Geo and Ocean Thermal Energy' and 'Energy from Waves and Tides'. As for wind resources, these have been mapped in great detail at heights of 10, 25 and 50 m, the latter for power generation. Threshold density of wind energy is 200 W/m^2 for feasibility studies for the type and size of wind generators currently employed in India on large scale (India is fourth in the world in wind energy utilization and fifth in manufacturing). This chapter covers all the methods of analysis, including Weibull distribution. The chapter on wind turbines is preceded by Enercon data sheets (which look like an advertisement rather than part of the data sheets for all the wind machines in use) and this is rather unfortunate in a book of this kind. This chapter is excellent, but does not show how to choose the machines or design a wind farm, starting with available wind data and whether one should have a wind