Book reviews

T. Burton, D. Sharpe, N. Jenkins and E. Bossanyi, *Wind Energy Handbook*, Wiley, 2001, 642 pp., £85.

This large tome by Messrs Burton, Sharpe, Jenkins and Bossanyi gives a detailed and technical description of the mechanical, electrical, aerodynamic, meteorological and planning aspects of modern wind turbines. The book opens with a very brief introduction to the historical development of wind turbines and their metamorphosis to the modern day wind turbine. This is then followed by a relatively short section describing surface boundary layer flow and its importance to wind energy.

Where the book really starts to get into its stride is its treatment of the aerodynamics of wind turbines. This section gets very mathematical very quickly and demands close attention by the reader. It begins with relatively simple actuator disc theory, through blade element momentum theory and on to the effect of tip losses. A detailed analysis is given of yawed flow and the reader is then introduced to the acceleration potential method developed from the study of helicopter rotors allowing a more detailed picture of the pressure drop across a wind turbine rotor than would be allowed from simple actuator disc theory. The section on aerodynamics then rounds off with a look at unsteady flow across a wind turbine rotor. This very well written and comprehensive section of the book is slightly spoilt by a number of typographical errors in some of the equations.

The next part of the book deals with wind turbine performance introducing the ubiquitous C_p-λ curve to describe power performance. The reader is introduced to the various ways in which wind turbines are regulated including pitching to feather and pitching to stall. Finally, this section deals with the testing of wind turbines in the field and the associated standards. The book then moves on to a very detailed description of the structural aspects of wind turbines covering the various design loads experienced by a horizontal axis machine, including extreme loads, fatigue loading, stationary blade loading and loading during normal operation. A good analysis of the dynamic response of tower and blades including teetering motion then follows.

A less mathematical section follows which describes how and why wind turbines are designed as they are, including the pros and cons of different types of power regulation, fixed and variable speed wind turbines, synchronous and induction generators, drive train logistics and upwind versus downwind configurations. The next section deals with the design of the different components of a wind turbine focussing on the blades but also touching on the rotor, gearbox, generator, brakes, yaw mechanism, tower and foundations. The book now moves on to the electrical aspects of wind turbines focussing on the turbine controller and its design to facilitate the different methods of power control and power quality.

At this point, the book focuses on the planning aspects of wind farms, taking some examples from the WindFarm computer program written by ReSoft. This section also covers the analysis of noise and electromagnetic interference from wind turbines. The section is rounded off by a brief look at finance and funding mechanisms for wind turbines looking mainly at the UK. The book concludes with a look at the electrical grid aspects of wind turbines when embedded in distribution networks covering such topics as power quality, electrical protection, lightning protection, connection charging and the impact on the system.

This book gives the reader a very rounded introduction to wind turbines at both undergraduate and postgraduate level. The coverage of aerodynamics and structural dynamics of wind turbines is quite specialist and very mathematical and is most suited for students at the postgraduate and research level. The price tag of £85 may seem a little high but represents good value for money for a book of this detail. This is an essential textbook for those who wish for a better understanding of the field of wind energy.

Simon Watson *Loughborough University*

R. E. Brown, *Electric power distribution reliability*, Marcel Dekker, 2002, 400 pp., $150.

There is rather general agreement in the power industry that reliability has become a very important issue, and that network operators (what used to be called 'utilities') should put the interests of their customers first. In several countries (among them the UK) regulators require the network operators to report the reliability of the supply. The interest in reliability monitoring and reliability improvement is thus obvious. Despite this, interest in reliability calculations remains small. During the last 20 years a whole stream of papers on this subject has come out of universities, with Ron Allan and Roy Billinton rightly taking the bulk of the credit. Their five-or-so books (I may have missed a few) on the subject have done a lot to spread the message that reliability can indeed be calculated. But still the amount of activity from the industry side remains small.

This book by Richard Brown is certainly not a repetition of the earlier books on reliability. Actual reliability calculations are only a minor part of the book: the main discussion is on how to use them. Now that a number of developers of power-system analysis software have included reliability modules in their programs, the need for a more practical discussion on reliability analysis is clear. This book may help in spreading the concept of reliability calculations to a wider audience.

The book starts with a number of rather descriptive chapters on the input parameters to a reliability calculation. Chapter 1 introduces the various components in a distribution system. This chapter would fit in any book on distribution systems, and as such has value on its own. Chapter 2 discusses the various ways of quantifying the reliability of a system. This is in my eyes the weakest chapter, being merely a long list of possible indices without providing much help on when to use which one. The author would have helped his audience a lot by stating right from the beginning that SAIFI and SAIDI together can do the job in most cases and that CTAIDI, $MAIFI_E$ and $STARFI_X$ merely lead to confusion (read the book if you're curious about the abbreviations). The chapter also contains a rather dangerous discussion on reliability targets, which could easily lead to the conclusion that the power supply is already too reliable.

Chapter 3 gives a very readable overview of all the possible causes of outages, including what can be done against them. Again, this chapter has a wider application than merely as a starting point for a reliability calculation. I read with interest the parts on the biology of power failures which includes 'bear-related problems', the wing-span of raptors, the length of snakes, and the growth rate of trees. In Chapter 4 the first signs of stochastic theory appear. Unfortunately the author goes into too much detail of the various probability distributions, where the rest of the book only sticks to exponential distributions anyway. Not that I am against some healthy mathematics, but I'm afraid that the non-academic reader will see this as a firewall and close the book just before it becomes really interesting. Chapter 5 gives a brief and well-structured description of reliability calculations in distribution networks. The author skips the mathematical details of the methods, although he does introduce some basics for Markov models. The non-mathematical reader should however jump immediately from Chapter 3 to Chapter 6, where the applications of reliability calculations are presented. This chapter is clearly the high point of the book: compulsory reading for anybody who wants to use a reliability calculation. In fact also for those who think that reliability monitoring will be sufficient. Chapter 7 gives another application of reliability calculations: optimisation.

This is altogether a highly recommendable volume, albeit not as an academic textbook. The book is too practical for that, but anybody lecturing on power-system reliability or on distribution systems should read it.

Math Bollen *Chalmers University of Technology*

Allan D. Kraus, *Matrices for Engineers*, Oxford University Press, 2002, 272 pp., £19.99.

The use of matrices and their manipulation are important mathematical tools in much of modern engineering. Allan Kraus has aimed this book solidly at students and those engineers wishing to revise their knowledge of these tools. The style used makes it suitable for self-study. Topics are presented in an uncluttered style, with an emphasis on building competence in matrix methods, rather than showing formalised proofs of the methods themselves. Plenty of numerical examples are given throughout. The level of the text is by necessity introductory, and the book takes the reader as far as Eigenvalues and the Cayley-Hamilton theorem. The book is a very good core or support text for undergraduate courses on matrices and can be recommended to graduate students for self-study.

Mike Barnes *UMIST*