Book Reviews

An Introduction to linear and nonlinear finite-element analysis—a computational approach by Prem K. Kythe and Dongming Wei, Birkhauser Verlag, AG, Klösterberg 23, CH 4010, Basel, Switzerland, 2003, pp. 445, chF 144.

Finite-element methods (FEM) were originally used by mathematicians as a method of interpolation and later adopted by engineers as a basic tool for numerical solution of a large class of problems in fields such as structural mechanics, heat transfer, fluid dynamics, wave propagation and electromagnetics. It is currently the most popular technique in the field of computational structural mechanics (CSM) for stress analysis of large-scale complex structural systems. Several software are available today based on FEM to handle a variety of problems in a wide spectrum of fields in science and technology. Development of FEM had to go in parallel with the development of computing power and this was essential to realize the application of the technique to real large-size practical industrial problems. FEM achieved acceptance by industry and standards are established to evaluate different software developed or being developed. In several universities, this is one of the most preferred elective courses with students from various disciplines opting for it. Teaching FEM for students of different backgrounds is a challenge for the teachers.

Today there are many textbooks on finite-element methods. Many of them expose the technique to students from a variety of angles and some of the books keep specific application in mind. However, there is a special approach adopted by Kythe and Wei in this book. FEM can be looked upon as a numerical solution for linear and nonlinear differential equations governing various phenomena. For example, second-order differential equations such as Laplace and Poisson's equations are known to govern the elastomechanics in two-dimensional plane problems, heat transfer, seepage flow, torsion of bars and steady-state fluid flows of ideal fluids. In such cases, it is possible to present a unified approach to students of solid mechanics, fluid mechanics, chemical engineering, physics and geophysics the issues concerning application of FEM to their problems. Cross-fertilization of ideas across various disciplines becomes possible and scientists find it easy to move across the industries or research areas. The purpose of the authors with respect to this has been achieved in this book.

In tune with the philosophy of presentation of finite-element methods in this book, the authors initiate in Chapter 1, the weak variational formulation as a method of achieving approximate solution to boundary value problems. They defined functionals, classification of boundary conditions and the formulation Galerkin and Rayleigh–Ritz methods based on weak variational formulations.

Chapters 2–4 deal with one-dimensional problems. In a short and focussed second chapter, linear and quadratic Legrange shape functions and Hermite cubic interpolation functions are defined in real coordinate systems. The chapter also briefly introduces the parametric coor-

dinates. The linear and quadratic elements are used for solution of problems governed by one-dimensional second-order equations in Chapter 3. These cover problems of deformation of bars, heat transfer and laminar ideal and viscous flows between two parallel infinite walls with pressure differential. This chapter also introduces mixing of elements, and one-dimensional problems with two dependent parameters. Chapter 4 is completely devoted to solution of one-dimensional fourth-order equations governing Euler–Bernoulli beam bending problems using Hermite cubic functions. These chapters are provided with series of exercises for the students to work, analyse and learn.

Chapter 5 introduces the linear and quadratic shape functions for two-dimensional problems for three-noded triangular, four-noded quadrilateral and six-noded triangular elements. Also triangular coordinates (known as area coordinates) are introduced. Chapter 6 presents solution of Laplace and Poisson's equations with the elements presented in the last chapter. Presentation was restricted to single dependent variable problems. Plane stress/plane strain problems in two-dimensional elasticity, solution to deformation of membranes subjected to lateral pressure and torsion of bars are governed by these equations. Development of stiffness matrix is introduced in this chapter. Chapter 7 presents solution to a variety of two-dimensional problems covering heat transfer, torsion, seepage and fluid flows. A series of exercises in two-dimensional problems for a broad understanding of the issues are provided in these chapters.

In the authors own words, heat-transfer problems are dealt with in a number of chapters in this book. According to them the students find it convenient to assimilate the concepts easily with these problems. Chapter 8 deals with axisymmetric heat-transfer problems covering radial symmetry, polar coordinate system and axisymmetric elements of triangular and quadrilateral cross-section. Applications are presented for linear elements for heat-transfer analysis in solids and fluids, and nonlinear heat transfer in fluids wherein the viscosity of fluid is dependent on the temperature. Gauss–Legendre intergration is introduced which is very useful for integration in triangular and quadrilateral regions.

The development of finite-element method is presented till now across the disciplines based on the type of differential equation governing the field. The next few chapters go across phenomenologically classified fields. Chapter 9 presents one- and two-dimensional transient problems. Time-dependent heat-conduction problem is addressed using time-integration method. One-dimensional nonlinear problems are presented in Chapter 10 which need an iterative method of solution. Primarily, Newton's method is used, whereas nonlinear gradient methods are also presented. Chapter 11 is fully devoted to the stress analysis of plane elasticity problems. Newtonian and Power-law non-Newtonian Stokes flow problems are presented in Chapter 12. Finite-element analysis is conducted with linear triangular and bilinear rectangular elements. For linear problems the method of steepest descent and the conjugate gradient methods and for nonlinear problems nonlinear conjugate gradient method are used. Chapter 13 presents solution for eigenvalue problems dealing with vibrations of Euler beams and plate/panel type of structures. The energy functional is formulated based on Hamilton's principle and governing differential equations are derived. Several examples are presented on simple structural elements such as plastic rods. Finally, the authors present in Chapter 14 certain new codes in Mathematica, Ansys, MATLAB and FORTRAN for use by students of the course.

I have enjoyed the style of presentation of finite-element methods by the authors. Generally, structural engineers consider finite-element methods as a natural choice for stress analysis of several structural components. A well-conceived approach, on the other hand, is presented in the current book exposing FEM as a technique which can be used to solve problems in several disciplines. The course based on this text book is divided into two semesters. Such a course will be very useful for students of several disciplines of science and engineering.

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Mathematics and computer science III edited by Michael Drmota, Daniele Gardy, Philippe Flajolet and Bernard Gittenberger, Published by Birkhauser Verlag, AG, Klösterberg 23, CH 4010, Basel, Switzerland, 2004, pp. 554, chF 178.

This book contains a collection of papers which were presented at the International Colloquium of Mathematics and Computer Science held in Vienna during September 2004. The presentations consisted of invited talks, contributed papers (oral and poster). The book is divided into seven parts, Combinatorics and random structures, Graph theory, Analysis of algorithms, Trees, Probability, Combinatorial stochastic processes and applications.

The first part on Combinatorics and random structures consists of eight papers. The first paper deals with common distribution of intervals in pairs of permutations. The second provides generating functions for generalized Frobenius partitions. The third one is on integer partitions and the fourth on 321-avoiding permutations. The fifth one considers iterated logarithm law for cycle length of a random permutation. The sixth one deals with a sufficient condition for transcendence of generating functions of walks on the slit plane. The seventh and eighth are on some curious q-series expansions and relations between number of partitions and the divisor functions, respectively.

The second section is on Graph theory. It consists of five papers. The first one deals with Hoeffding decomposition to prove asymptotic normality of subgraph counts statistics. The second one considers "avalanche polynomials" on certain families of graphs. The third one gives a detailed analysis on perfect matchings in random graphs with prescribed minimal degree. The fourth one provides very tight estimates for the growth constant of labeled planar graphs. The last paper presents an algorithm for finding the number of spanning trees in P4-reducible graphs.

The third section is on Analysis of algorithms and contains seven papers. The first paper considers specific search cost in random binary search trees. The next one is on probabilistic bin packing. The third one considers algorithms for computing Walsh–Hadamard transform. The fourth one is on randomized algorithm to evaluate Boolean decision trees. The fifth one is on polynomial time perfect sampling algorithm for two-round contingency ta-

bles. The sixth one is on a new efficient algorithm for the generation of unlabelled cycles. The last one is on the use of tries for universal data compression.

The fourth section is on Trees. As this section is on an important data structure, it contains nine papers. The first paper is on new Strabler numbers for rooted planar trees. The second is on basic parameters of suffix trees. The next two are on binary search trees and complete binary trees, respectively. The next three are on interval trees, unlabeled ordered trees and monotonically labeled trees, respectively. The eighth one contains a poof for local central limit theorem for the number of vertices of a given out degree in a Galton–Watson forest. The last one gives a precise analysis of the cost distribution for destroying recursive trees in the case of toll functions of polynomial growth

The fifth section is on Probability and contains the maximum number of papers (10) in the volume. The first discusses the probability that the maximum in a geometrically distributed sample occurs in the first d positions of a word. The next describes the duality between a fragmentation associated to certain Dirichlet distributions and a natural random coagulation. The third considers semi-Markov walks. The next two are on fixed points. The sixth provides central limit theorems for the number of descents in samples of geometric random variables. The seventh one describes a new large derivation phenomenon for cascades. The next is on partitioning with piecewise constant eigenvectors. The ninth paper considers branching process in random environment and proves a limit theorem. The last studies the joint distribution of the number of individuals at the origin and outside the origin in a continuous time random walk on integers.

The sixth section is on Combinatorial stochastic processes and has six contributions. The first one considers a model of particles jumping on a row of cells with general boundary conditions where the stationary distribution is not uniform. The second one studies stochastic deformations of sample paths of random walks. The next one is on Markov chain algorithm and the fourth one is on regenerating composition structures. The fifth one is about random walks on groups with a finite set of generators. The last paper of this part gives a fractal construction of nested, stable regenerative sets.

The last and the seventh section is on Applications. It contains nine papers. The first paper considers numeration schemes and the next Trellis codes. The third and the fourth show applications related to logic. One provides a zero-one law for first-order logic for random images and the other studies threshold phenomena for random generalized satisfiability problems. The fifth one shows application in stochastic chemical kinetics and the sixth one deals with partitions. The seventh also shows application in biochemistry to quantitative polymerase chain reactions. The eighth one deals with the problem of decidability of simple brick codes. The last paper generalizes Sauer's lemma to finite VC-dimension classes of binary valued functions.

Thus the book contains seven sections and 54 contributions. All are on current topics of research and this book will be useful for a researcher working in these areas. Throughout the book, mathematical symbols and figures are clear. Though in the preface a mention is made about invited talks, in the text there is no way to distinguish an invited paper from a contributed paper. A person scanning through the book probably would like to see the in-

vited papers first as some of them are carefully crafted surveys in the respective field. This book will be useful for researchers working in fields such as random structures, graph theory and stochastic processes.

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Modeling, simulation and optimization of integrated circuits by K. Antreich *et al.*, Published by Birkhauser Verlag AG, Klösterberg 23, CH 4010, Basel, Switzerland, 2003, pp. 376, chF 186.

The above is the proceedings of a conference held at Mathematische Forschungsinstitut, Oberwolfach between November 25 and December 1, 2001. It is a very good, though not comprehensive, collection of state-of-the-art papers (which have a tutorial and `survey' content in addition to original work) by leading experts on the numerical aspects of the study of integrated circuits indicated in the title. The conference appears to have been organized with the aim of summarizing the state of the art for practitioners rather than that of emphasizing novelty. There have been two earlier conferences on numerical simulation in electronic industry at Oberwolfach in 1988 and 1992. These concentrated on device and process simulation. In the present conference additional topics have been introduced: Cosimulation, the coupling of different simulation tools with strongly varying time scales and electromagnetic effects and a number of topics covering basic concepts such as Runge–Kutta, solution of sparse systems, etc.

The broad titles covered in this book are: Device simulation and applications, Circuit simulation and differential algebraic equations, Coupling of devices and circuits, Circuits with stochastic sources and Advanced mathematical tools. Under each title one finds the following kinds of papers: one or more on basic mathematical techniques of simulation, one or more on modeling techniques emphasizing some physical principle, one or more on design applications. There are also papers on problems in the industry.

The papers are invariably well written emphasizing essential ideas rather than technical details with excellent bibliographies. The reviewer would strongly recommend that practitioners in this field to have access to this volume. The book could also be used with profit as a convenient reference for courses in this area.

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Guidance and Control 2005, edited by William Frazier and Robert D. Culp, Published by Univelt, Inc., P. O. Box 28130, San Diego, California 92198, USA, Vol. 121, 2005, pp. 618, $ 150 (Hard cover plus CD), $ 110 (soft cover plus CD).

Guidance and Control 2005 is volume 121 in the series *Progress in the Astronautical Sciences* and is a publication of the American Astronautical Society (AAS). It is a record of the proceedings of the 28th AAS Rocky Mountain Guidance and Control Conference held during February 5–9, 2005, at Beckinridge, Colorado.

The hardcover volume of 598 pages is accompanied by a compact disk containing the entire proceedings in pdf format. The compact disk is readable in both Linux and Windows systems.

The 87 papers presented at the Conference are divided into seven sections. Each of these sections will be briefly reviewed below. Some of the papers, which are of interest to the reviewer, will be gone into in a little detail.

1. *Advances in guidance and control*

This section consists of eight papers. In a sense, this section is the theme section for this Conference. The paper entitled "Autonomous star tracker development and qualification for the new horizons mission" presents an overview of the mission and the design considerations and operating modes for the modified A-STR tracker. In "Line of sight stabilization for the James Webb space telescope" the authors describe what is being done to achieve milli-arcsecond pointing stability of the line of sight of this instrument which is due to be launched in 2011.

The authors of the paper entitled "Solar sail attitude control performance comparison" argue that both methods of attitude control by solar sails studied by them, one employing four articulated reflective vanes located at the periphery of the sail assembly, and another using mass on a gimballed boom to alter the centre-of-mass location relative to the centre-of-pressure thereby producing control moments, seem to work equally well. "Control moment gyroscope (CMG) for small agile satellites" gives details of the design philosophy, manufacture and use of control moment gyroscopes for controlling the attitude of small, agile Earth observation satellites. Such satellites need to be small and rigid in order to be rapidly manoeuvrable, and CMGs are well suited to the task.

In the paper entitled "Advancing the next generation GOES-R operational availability" the authors tell about the measures being contemplated for increasing the availability of the GOES series of geostationary Earth observation satellites. A geostationary satellite needs to be manoeuvred into its designated slot and the momentum is acquired by the control wheels dumped every now and then. Each time either of these manoeuvres is done, the onboard instruments have to be recalibrated . The accumulated time so lost can amount to a significant fraction of the satellite's lifetime. The paper discusses several ways of reducing this lost time. It advocates carrying out these manoeuvres 'continuously' rather than only at discrete intervals after sufficient position error or control momentum has accumulated. To implement this it proposes the use of laser ranging/GPS techniques for precise determination of position and the use of 'always on' plasma thrusters for stationkeeping and momentum dumping.

2. *Tutorial–University research in guidance and control*

The five papers in this section are tutorial in nature. The first one, named "Geolocation for the ICES at laser altimeter" is a discussion on the methodologies used to geolocate the spot illuminated by the laser altimeter onboard the NASA ice, cloud and land elevation satellite (ICESat) which has a near-circular orbit of altitude approximately 600 km and inclination of 94 degrees. The precision laser altimeter measures the scalar altitude but the science applications of this measurement require removal of the orbital motion in order to extract the profile of the Earth's surface. True to its tutorial nature, this article provides details of the analysis, design and implementation of the altimetry concept and the instrumentation. It is informative.

The paper "Orbit and attitude determination concept of the joint Australian engineering (micro) satellite JAESAT" outlines the JAESAT orbit and attitude determination concept and discusses results based on tests conducted and simulations related to functionality and performance.

Multiple satellites orbiting in formation are an alternative to monolithic ones for certain kinds of mission. An example of such a system is NASA's Terrestrial Planet Finder (TPF), to look for Earth-like planets around nearby stars. The advantages of such a system include the ability to create large aperture radio sensors, mission flexibility and reliability and the ability to deploy in stages and upgrade easily. For example, one of the proposed architectures for the TPF is an infrared Michelson interferometer consisting of five spacecraft flown in formation. Formation flight requires precise control of the relative positions of the component spacecraft. If the formation were to be maintained by using fuel alone, the lifetimes of the spacecraft would be strictly limited. An alternative is to create a steerable magnetic dipole to control the configuration through electromagnetic forces. In conjunction with reaction wheels this can control the relative separation and attitude of the satellites in the formation. This concept is still under test and development on the ground. The concept of satellite formation flight and formation keeping is an interesting one with much potential.

An application of the GPS to the determination of the position and attitude of high performance aircraft, including the practical issues of implementation and flight testing, is discussed in the paper entitled "Precise positioning and attitude determination in high dynamic flight testing".

The paper on "Tracking inaccessible signals in linear systems: a brief tutorial" is about a theory for tracking inaccessible signals in linear time-invariant systems. This may be useful, for example, in determining the trajectory of an uncooperative target. This paper is purely mathematical, with something for a research student to 'bite' on! However, the list of references is far from comprehensive, citing mostly papers presented at earlier conferences by the author.

3. *Robotic exploration*

This section features four papers. "Path planning algorithms for the adaptive sensor fleet" is a description of three path-planning algorithms which, in combination, enable a fleet of wa-

ter surface vessels to safely and efficiently reach a defined region from arbitrary initial positions in preparation for a cooperative survey of the region.

"A unification of artificial potential function guidance and optimal trajectory planning" demonstrates an apparently unappreciated relationship between artificial potential function guidance and a form of optimal planning called receding horizon planning. This appreciation allows high-quality trajectories to be calculated in real time. "Autonomous walking inspection and maintenance robot" proposes a robot which will remain on the outside of an interplanetary or deep space exploration vehicle and look for and repair or report damage from micrometeorite impacts. Finally, "Mobius, an omnidirectional robot utilizing meccanum wheels and fuzzy logic controls" is a report of an effort to develop a ground vehicle robot as part of an investigation into novel omnidirectional locomotion technologies.

4. *Planetary exploration*

Of the five papers in this section the two that seemed most interesting have both to do with inflatable decelerators for re-entry space vehicles. "Inflatable aeroshells as an alternative aerodynamic decelerator" describes aeroshells that can be significantly enlarged after release from the launch vehicle. This would overcome the volume (and hence drag) constraints imposed on the conventional blunt body, rigid aeroshells. This is especially important for entry, descent and landing of, say, a manned mission to Mars due to the low density of the Martian atmosphere. Also, return of cargo from the International Space Station could be enhanced by the use of spacecraft that minimize the mass and volume necessary to launch such vehicles to the ISS. The concept is still in the research stage but, according to the authors, holds much promise.

"Use of ballutes for performing controlled re-entry" is another paper on a similar subject. A ballute (balloon-parachute) is an inflatable device that increases the aerodynamic drag of a spacecraft. Performing aerocapture with a ballute rather than the more conventional rigid aeroshell can lead to significant saving in terms of fuel mass as well as lead to lower heating rates. Landing location may be controlled by controlling the ballute release altitude and, to a more limited extent, by controlling the ballute attitude. Again, this concept is as yet under development.

Of the remaining papers in this section, "Potential entry guidance modifications to improve landing accuracy for the 2007 Phoenix Mars Mission" describes some of the possible uses of guidance to control range during entry of the robotic Mars mission known as Phoenix, due to be launched in 2007. "Control and data systems challenges in design of the Jupiter icy moons orbiter spacecraft" is a long paper that describes in fair detail several possible command and control configurations for the named mission. "The many faces of the Mars sample return mission architecture" is an attempt to summarize the guidance and control challenges facing a purported unmanned mission to Mars whose aim is to return to Earth samples of the Martian environment.

5. *GN&C When things go 'bump'*

This section has seven papers dealing with emergency situations, and deals with the effects of hazardous ionizing radiation and subatomic particles on the onboard electronic circuits.

6. *Recent experiences in guidance and control*

This, the penultimate, section again consists of seven papers. Each of them describes the experiences and problems with guidance and control of a specific scenario. Among them are the first in-orbit results from the DEMETER satellite; flight performance of the Spitzer space telescope AST-301 autonomous star tracker; and an active system to compensate for Martian high winds during landing of the Mars exploration rover.

On-orbit anomalies are a fact of life, and their successful management can make the difference between a successful mission and a crippled one. The paper entitled "Proactive spacecraft operation and maintenance and the anomaly management process" provides examples of proven anomaly management techniques and their effect on spacecraft performance and longevity. The romantically named "Through the Wild 2 Dust" is a paper that describes the ground testing of the attitude control system of the STARDUST comet probe and also its inflight performance during encounter with the comet Wild 2, during which it successfully collected samples of the coma and images of the nucleus.

7. *Technical exhibits*

The concluding section gives a summary of technical exhibits at the Conference and also contains a paper describing the Java Astrodynamics Toolkit (JAT), a library of software components in Java for space mission design. Most interestingly, the JAT is free software that is distributed under the GNU General Public License and is freely downloadable from http://jat/sourceforge.net. This reviewer visited this website to learn firsthand what JAT is about. It presently features such useful applications as astrodynamics constants, time and coordinate transformations, quaternions, orbit element conversions, two-body and restricted three-body gravity models, attitude dynamics, atmospheric drag models and much more. Under development are libraries for n-body gravity models, orbit of estimation of both batch and Kalman filter and direct and indirect methods of trajectory optimization. The JAT seems to be an active project with updates being posted regularly.

In the opinion of this reviewer "Guidance and Control 2005" is successful in bringing to those interested the latest advances and the state of the art in guidance and control as applied to spacecraft. In the Indian context it will be useful to those who are responsible for the long-term planning of the country's space goals; and to those also who desire to get a wide sample of what is presently going on in the area of guidance and control of spacecraft. The tutorials section gives details of the implementation of some systems.

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Intellectual property rights for engineers, 2nd edition, by V. Irish, Published by The IEE, Michael Faraday House, Six Hills Way, Stevenage, Hertfordshire SG 1 2AY, 2005, UK, pp. 208, £ 26.

Many books have started appearing in the area of intellectual property rights (IPR) with varying degree of focus on different readerships. This book is addressed to engineers and brings out quite clearly the basic concepts of different forms of IPR, which are relevant to engineers. It is a natural choice of the author to discuss case studies and case laws from electronics and electrical engineering as the book has been published by the Institution of Electrical Engineers. The most positive aspect is that it has kept away from citing sections from various laws on IPR to make it more palatable to engineers and scientists who, to start with, are not comfortable to enter into the depth of laws.

The author has started with copyrights, which are usually not considered to be very stringent rights. However, this right provides a good protection for engineering drawings, which are important for engineers of many sorts. The coverage of copyrights is quite comprehensive to get an idea about the basic framework of copyrights as per the UK laws and therefore Indian readers and engineers will have to keep this aspect in mind while reading this book. The book explains some new concepts about copyrights such as protection of synthesized speech created by a computer program through copyrights. It is often asked as to what would constitute an infringement of copyright? How much copying is allowed from an existing work so as not to be considered an infringement of the existing work? It has been quite nicely explained that if one is benefiting from use of the copyright work by saving oneself time and effort instead of producing an independent version, then usually there has been infringement. This would be largely applicable in the Indian context as well except in cases when the copying is considered as an action for fair use such as research. It is quite interesting to note the fresh view it has taken about computer software. It may be recalled that translation of a work without the consent of the author is considered infringement. One usually associates translation with human languages. The British law, however, applies it to computer languages as well. "The owner of copyright in a program can control its conversion into a different computer language and its conversion into or out of computer code. Conversion from source code to object code is therefore included, and vice versa." In other words, a copyrighted software cannot be rewritten in a different language or converted into object code without infringing the original copyright. For all practical purposes this would be treated as translation of the work. It should be possible to extend the same explanation to the Indian laws also. The book has successfully brought out the fact that if copying is done purely for personal and domestic purpose, it may not be considered infringement in case of recording broadcast and cable programs. The UK has a central body dealing with licensed copying of books and journals on behalf of authors and publishers. The Copyright Licensing Agency authorises copying, collects royalty payments and passes the appropriate percentage to the author or publisher.

The chapter on designs is revealing because it talks of a new concept evolved in UK for protecting functional designs, which is different from the commonly known protection under the Industrial Designs (Registered Design). This law came into force in UK in 1989. Industrial design deals with external appearance of an article in terms of shape, configuration,

ornamentation, etc. and does not concern itself with the functional aspects of the article. There is no provision of protecting functional design in the Indian law. It may be noted that there would be design aspects, which may not be patentable. This chapter also covers the protection of IC layout designs (semiconductor chip design) under the topography rights. An interesting data has been disclosed which says that the cost of designing a new chip having 25 million transistors is several million pounds and the cost of copying the same may be about one hundred thousand pounds. This clearly establishes the need for this type of protection. The topography design excludes PCB because PCB is a pattern, which is protectable under design. Multiple protection through multiple IPR has been explained well. For example, a statue as an article can be protected by registered design and its drawing by copyright. For most engineering practitioners both industrial design and functional designs are bread and butter of their profession and hence they must have an understanding of how they can legally protect their intellectual property rights.

The topic on patents has been tackled in a conventional manner without going into details of other related aspects such as patent searches and other searches for determining novelty, inventiveness, etc. which are very important for determining if an invention is really patentable or not. I suppose that more time could have been devoted to International Patent Classification system, which is emerging as the best system for carrying out patent searches. The book discusses some very good case studies on granted patents, which are worth reading by electrical and electronic engineers. The comparative analysis of two patents related to optical fibre by Siemens and Industrie Pirelli SPA is an excellent example of how patent documents should be analysed.

Issues related to confidential information have been well articulated and it would be a good quick reading for those who want to have a basic understanding about this subject. Issues in respect of employee–employer relationship are increasingly becoming important even in India when it comes to alternative employment of the employee in a company engaged in similar activities as the earlier employer.

Unfair competition in regard to IPR is a serious matter, which needs to be guarded against in any technology transfer and IP licensing deal from a long-term perspective. Each country may have its own laws in this regard and at present there is lack of harmonization among countries in this matter. Various shades and forms of unfair competition have been explained well and readers should read carefully the restrictions, which may be placed in the above deals by the supplier of technology and/or intellectual property. For example, a restriction may be placed on independent R&D in an unconnected field during the agreement or fixing a price limit on the product or restriction on sales rights, etc. The word of caution is that many of such restrictions would be treated as unfair competition in the country of the supplier and hence these should be challenged right at the beginning. However, the first requirement is that there has to be an awareness about these issues/matters. This topic is usually not covered in many books dealing with IPR.

Ownership of intellectual property rights has been discussed in reference to all forms of IPR and it has been discussed in a practical manner by reflecting on issues related to income tax as well. It is important to appreciate that an employer would like to exercise his rights in any intellectual property that is created in his company by its employees. Engineers as employees should not feel bad if the ownership is retained by the employer.

Engineers love to see things happening on the ground, and therefore, would be interested in how inventions could be put into practice. Licensing and transfer of inventions is an important step in that direction and many of us face the initial difficulty as to how to start the whole process and complete it successfully. The book covers broad principles of licensing but has failed to capture this aspect in an adequate manner. There are many practices in vogue for licensing intellectual property from academics, R&D institutions and industries. An exposure to such practices would have been useful. During my interaction with many engineers and scientists, it comes out that they would like to understand some details about licensing of intellectual property along with the principles. In other words, case studies would be useful.

The book as mentioned earlier is different from other books in the sense that it does not take much time in dealing with various treaties but comes to the point quickly. Therefore, it has not discussed TRIPS in detail but brings out the features of each form of IPR in each chapter so that the reader may establish proper linkages. No references and bibliographic information are included in the book and therefore it is sometimes difficult to cross-verify some concepts and analysis presented in the book. It is to be understood that the book is predominantly meant for engineers practicing in UK because all its treatment is around the UK laws. It is a very useful reading for engineers in India because a large portion of laws would be common. However, readers practicing in India should recognize this fact and tune their understanding accordingly. The book is recommended for engineers, scientists engaged in physical sciences and also managers in engineering industries.

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Biochemistry and molecular biology of plants, 2004, edited by B. B. Buchanan, W. Gruissem and R. L. Jones, First Indian reprint, I. K. International Pvt Ltd, Delhi 110 016, 2004, pp. 1368, Rs 1595.

This book was originally developed and published in the year 2000 by the American Society of Plant Biologists (ASPB). According to Prof. Tatsuo Sugiyama, "This is an inspiring text for students of plant biology at all stages of their education" (quoted from the flyer/prepublication announcement of this book published by ASPB). The key references are grouped under the heading of Further Reading at the end of each chapter. The softbound copy of the American edition (ISBN: 0-943088-37-2) was priced at $119.95 for ASPB members and students and $149.95 for nonmembers. A CD-ROM containing over 1,100 full-color original illustrations and over 500 photographs, priced at $29.95 is also available from ASPB. Considering the price, the American edition has been beyond the reach of most of the students and teachers in the Third World countries. It was therefore most appropriate of I. K. International to have published an Indian reprint by agreement with the ASPB for sale

in the Indian subcontinent only. Although the price of this edition is relatively low to be affordable by libraries in many colleges, it is still prohibitive for most of the students.

A few words about the book. It is the most outstanding and modern account of plants which is very useful for teaching and research. Each chapter is written by the most outstanding and leading experts in the field. In terms of content and style of presentation, the book is highly readable with plenty of figures, tables and boxes. In the original edition most of the figures are in color. These efforts have ultimately culminated in a worthwhile volume not only for teaching but also to own it as several of us want to read it at leisure and think about the depth of arguments. At present it enjoys unparalleled reputation among the plant biologists. The interdisciplinary account really makes it a multipurpose one and especially appealing. It is a pleasure reading it and even triggers new lines of thought for serious research scholars and students.

The Indian publishers have done an excellent job. The softbound reprint is of high quality. During reproduction, a few omissions have been introduced, e.g., the broken 'g' at the end of line 6 from bottom on page 323. However, unlike the American edition, not all the color illustrations are reproduced in this edition in color. The reproduction of many figures in black and white (BW) has led to loss of information, either partially or completely so that at times it is difficult to follow the message. I will restrict my comments to the figures in Chapters 7 through 12 only. This limitation, however, applies to many other figures in the remaining chapters.

1. Figure 7.4, page 314: In the absence of color, TMV A and TMV B look similar and are not distinguishable.

2. Figure 7.18, page 322: It is difficult to follow the pattern of inheritance of RFLP markers in BW (e.g. cdo455 which is marked in red color in the original edition).

3. Figure 7.33, page 333: If this figure had been in color, it would have been rather easy to follow the structure and transposition of a transposable element and the role of inverted repeats in acting as a stem for transposase.

4. Box 7.2, page 326: In the absence of color pictures, it is difficult to follow the fate of different DNA inserts/segments during gene cloning. This drawback is especially felt as para 3 on page 327 refers to color-producing genes and colored colonies.

5. Figure 7.39, page 339: The localization of gene expression of KNAT1 is not obvious in the BW figure.

6. Figures 7.51 and 7.52, page 352: Reproduction in color is absolutely essential to explain the concepts of imprinting and paramutation.

7. Figure 8.8, on page 367: The trend of the two curves (wild type and GS2-deficient mutant) can be followed but with reduced clarity.

8. Figure 8.14, on page 371: In BW figure, the distinction between GDH1 and 2: homohexamers and heterohexamers has disappeared.

9. Figure 8.23, on page 379. The damaged area in the leaf due to high intensity light is barely visible.

10. Box 8.7, on page 392. This box depicts a very important concept namely 'how genetic tools that become available from studies of biochemical genetics can open up new ap-

proaches to studying seemingly unrelated areas of biology'. Since the blue fluorescence phenotype is not evident in BW figure, it is really difficult to understand the epigenetic changes and the notion of gene silencing.

11. Figure 9.7, page 417: Although referred in the legend, blue, orange and green colors are missing in the BW figure.

12. Figure 9.12, page 421: One should look at the figure in color to understand the mechanism of polypeptide chain initiation.

13. Figure 10.28, page 486: The distinction between the two sets of bars is far less evident in the BW figure.

14. Box 10.4, page 499: Distinction between different phospholipids has disappeared in the BW figure.

15. Figure 11.5 (B), page 535: Details of curve depicting cyclin abundance have disappeared in the BW figure.

16. Box 11.2; page 537: In the section on conclusions, relative abundance of RNA is difficult to decipher in the BW figure.

17. Figure 12.8, page 580. To fully appreciate the various products of carotenoid biosynthesis pathway, there is no substitute to the original color figure.

18. Figure 12.19, page 591: In the BW figure, it is difficult to make out the lateral heterogeneity of the chloroplast membrane complexes.

19. Figure 12.41, page 615: The demarcation between the carboxylation and reduction phases, so nicely shown in color, is barely evident in BW. In the latter, the diagonal line is barely visible and its importance cannot be deciphered.

In order to overcome the shortcomings of BW figures in the Indian edition, I would suggest that this edition be sold along with the CD of the figures. This would enhance the value of the Indian reprint and will also at the same time become cost-effective. This CD is also an invaluable tool (or aid) for teaching. One would like to see an improvement in the quality of paper also so that the print impression is not visible on the other side of the paper. The original edition does not have this drawback. In the future Indian reprints, I suggest that all the figures be reproduced in color. Being a milestone in plant biology, this book is highly recommended to all the students of plant biology. It is dedicated to late Joseph E. Varner, who was a Professor at Michigan State University Department of Energy Plant Research Laboratory and had made outstanding contributions to the biology of plants. Having been associated with Joe Varner during 1965–68, the present reviewer has even a stronger attachment to the book at personal level.

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