

## BOOK REVIEWS

Dawson and Folimonova is specific in focusing on the perspectives of building viral vectors for perennial crops with a case study on *Citrus tristeza virus*, which could be considered as value-added traits for plant improvement. Four articles emphasize the usefulness of host resistance. Among them, the article 'Antimicrobial defenses and resistance in forest trees: challenges and prospective in a genomic era' by Kovalchuk *et al.* explores the role of host resistance in the defence response of forest trees to their pathogens. This article has its own merit in the sense that molecular pathology of forest trees is less studied in comparison to the pathology of agricultural crops. The genetics, function and evolution of disease resistance genes in plants having been well understood by the article on 'Impacts of resistance gene genetics, function and evolution on a durable future' by Michelmore, the article by Schornack has given further insights on new strategies of disease control by a review on the modulation of TAL effectors of pathogens by plant resistance mechanisms. Likewise, the article by Kumar and Mysore provides an overview of non-host resistance and its exploitation for durable resistance in plants. Though specific to bacterial pathogens, the concepts are becoming central to other pathogens as well. The behaviours of plant diseases have been examined by Boudreau by analyses of their effects on disease dynamics. Intercropping being one of the agro practices for disease control, an improved application in disease control can be enabled by such studies. The reviews on *Trichoderma* and prophages analyse them from a genomic perspective, giving further impetus on their exploitation in advancing management strategies to contain plant pathogens. With the completion of several genome sequences of the pathogenic and non-pathogenic microbes, the contribution of genomics in understanding the bioagents is of interest. The article by Varani *et al.* establishes the role of prophages in bacterial diseases by an integration of available information. The author has also highlighted a unique interface for assessing the biology of prophages and their association with genome evolution and pathogenicity. The article by Mukherjee *et al.* focuses on the biology of the widely explored biocontrol agent, *Trichoderma* sp. and its interactions in the context of contemporary

genome research. The nine articles in general advocate the understanding of molecular complexities of host resistance or bioagents so that they can be successfully exploited for the management of plant diseases.

Understanding the etiology, survival, ecology and evolution of plant pathogens can have practical implications, especially in developing strategies for controlling these pathogens. Also, the unique biological systems combined with specific spatial and temporal dynamics account for the epidemics of each type of pathogen. From the article by Garbelotto and Gonthier, the possible causes for the epidemics of *Heterobasidion* sp. could be identified besides understanding their biology and mode of control. In view of the advances in molecular and genomic studies, the articles by Futai, and Castagnone-Sereno *et al.* hold good in understanding the biology of the pine wood nematode *Bursaphelenchus xylophilus* and of the root-knot nematode, *Meloidogyne* respectively. Likewise, the articles on the two major groups of plant viruses, i.e. 'Advances in understanding Begomovirus satellites' by Zhou and 'Continuous and emerging challenges of Potato virus Y in potato' by Karasev and Gray advance our knowledge on their diversity and evolution. Zhou has also highlighted the usefulness of begomoviral satellites as ideal candidates for conversion to VIGS vectors. The articles by Purchell, and Morris *et al.* with their reviews on *Xylella fastidiosa* and *Pseudomonas syringae* respectively, exemplify that paradigms can change our understanding of plant pathogens. The rational use of resistance genes and pesticides greatly depends on the knowledge of the principles and consequences of competition among pathogen strains. The review on 'Experimental measures of pathogen competition and relative fitness' by Zhan and McDonald justifies this by an exhaustive analysis of pathogen competitiveness. Clearly, the eight articles give a comprehensive understanding of the fundamentals about plant pathogens.

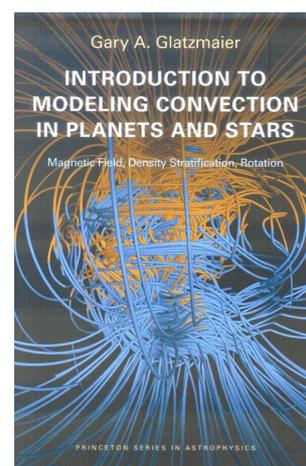
The compilation of the advances in concepts of varying aspects of modern plant pathology with an indepth analysis focused on the future, make this volume, a valuable resource for all those interested in crop protection. It is useful to students, researchers and policy-makers. The volume has tried to cover a wide

spectrum of topics in plant pathology and has succeeded in its endeavour.

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**Introduction to Modeling Convection in Planets and Stars: Magnetic Field, Density Stratification, Rotation.** Gary A. Glatzmaier. Princeton University Press, 41 William Street, Princeton, New Jersey 08540, USA. 2014. 344 pp. Price US\$ 65.00 (paper), US\$ 99.50 (cloth)/ £ 44.95.

Origin of magnetic field in the planetary cores and stellar atmosphere through a dynamo process has been an interesting and challenging area of research ever since the idea was first proposed by Larmor in 1919. The past two decades have seen significant progress in this field mainly due to the developments in high performance computing and availability of fast computing power which have enabled researchers to numerically solve full 3D global magnetohydrodynamic (MHD) equations. The book under review by Gary Glatzmaier, a renowned researcher in geophysical and astrophysical fluid dynamics, who produced the first dynamically consistent computer simulations of geodynamo and geomagnetic reversal in 1995, is a well-deserved contribution to this field. The book is aimed at undergraduate and graduate

students interested in geophysical fluid dynamics. It introduces a complex subject in a simple manner, navigates through complexities and ends with listing advances in the subject area. At every step, even minor technical details related to numerical formulation are elucidated and motivation is provided for students to develop their own computer code. The book maintains throughout its flavour of tutorial exercises and computer projects at the end of every chapter. It is subdivided into three main parts – (1) The fundamentals, (2) Additional numerical methods and (3) Additional physics.

Part 1, consisting of seven chapters, reviews the concepts and equations of thermal convection and internal gravity waves, slowly builds on solution of these equations using basic numerical methods and introduces the skills for writing simple computer codes. The first chapter introduces two basic types of fluid flows within planets and stars driven by thermal buoyancy forces: thermal convection and internal gravity waves and then discusses thermal instability and equations of motion describing fundamental fluid dynamics. The chapter then introduces the Boussinesq approximation and develops the concept of Rayleigh–Bénard convection of an incompressible liquid in a rectangular box. This classical problem is set up step-by-step with appropriate governing equations and boundary conditions and two important non-dimensional control parameters, the Rayleigh number and the Prandtl number are introduced. The second chapter introduces vorticity–stream function formulation to solve the momentum equation discussed in the first chapter. The author then employs Fourier spectral decomposition in horizontal and finite-difference method in vertical direction to numerically solve the system of equations. The explicit and implicit time integration schemes are then presented and a second-order accurate explicit scheme, the Adams–Bashforth time integration scheme, is described. The chapter ends with demonstration of application of these schemes to solve the Poisson equation.

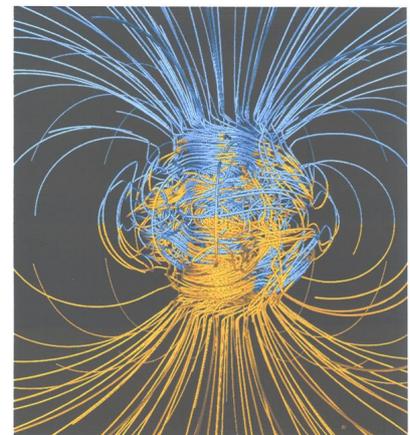
The third chapter deals with linear stability analysis. This is a good first step for those interested in developing codes to check their linear codes against analytical solutions. Here, the author describes how to couple the temperature, stream function and vorticity equations

while dropping nonlinear terms. Next, the guidelines for the development of code for this linear problem are provided. The author once again provides a systematic approach taking care of every minute detail to develop the code. Here, the critical Rayleigh number is described and motivation is provided to compute critical Rayleigh number and mode number for prescribed Prandtl number and aspect ratio of rectangular box. The chapter also presents analytical solution of this problem so that the accuracy of numerical linear code can be compared with the analytical solution. The fourth chapter builds the solution further by including nonlinear terms to develop a code for finite-amplitude simulations. In this chapter, the nonlinear terms are calculated using a Galerkin method in spectral space. The chapter describes the procedure to apply initial conditions, computing nonlinear terms, and saving data for post-processing. An important aspect of time-varying convection simulation is time-step control and nonlinear advection terms add further constraint on the size of the computational time step. The Courant–Friedrichs–Lewy condition is discussed with a graphical demonstration. The chapter also includes a benchmark for the nonlinear problem.

The fifth chapter is devoted to post-processing of results for graphical display using packages such as IDL and Matlab. A shell script in IDL for the display of snapshots of results stored in output files generated by the nonlinear code is also included. Another important step of post-processing is to check several diagnostic parameters of the obtained solution. A section is devoted to these diagnostic parameters such as Nusselt number, Reynolds number and kinetic energy density. The next chapter covers internal gravity waves in a stable thermal stratification and presents the governing wave equation derived from stream function, vorticity and temperature equations. The code modification to simulate internal gravity waves is discussed. The chapter also includes a case wherein a part of the box is convectively unstable, whereas the remaining part is convectively stable to crudely represent the interior of the sun. Another important process of double-diffusive convection, convection of fluid composed of two constituents with different densities, is discussed in the last chapter of Part 1. This chapter covers ‘salt-fingering’ and

‘semi-convection’ instabilities. Here, the critical thermohaline Rayleigh number is defined for the onset of salt-fingering or semi-convection. The next section derives critical Rayleigh number for the onset of oscillating instabilities. The chapter ends with highlighting the changes in the numerical code to use it for double-diffusive simulations.

Part 2 covers more technical aspects and intricacies of numerical simulations, solution techniques, boundaries and geometries. This section contains three chapters covering advanced numerical schemes to improve accuracy and efficiency of numerical codes as well as more technical issues of spatial discretization and boundary conditions. The first chapter presents three additional time integration schemes; fourth-order Runge–Kutta, semi-implicit and predictor–corrector schemes and their step-by-step treatment for implementation in numerical code. This chapter also discusses the intricacies of mantle convection and simplification of vorticity equation for infinite Prandtl number limit. The next chapter deals with implementation of non-uniform grid and coordinate mapping within a finite-difference method to improve the computational accuracy. Such a treatment is especially needed to tackle boundary layers. Further, fully finite-difference and fully spectral methods are discussed. The merits of using local methods, such as full finite-difference, compared to spectral decomposition are discussed and some intricacies of treating advection term in finite-difference form are highlighted. For fully



A snapshot of the magnetic field maintained in a geodynamo simulation illustrated as magnetic field lines. Gold field lines are directed outward and blue inward.

spectral methods, the use of Chebyshev polynomials in vertical direction is presented. The chapter also introduces parallel processing paradigm and briefly covers OpenMP and MPI approaches. The last chapter of this section begins with implementation of ‘absorbing’ top and bottom boundary conditions, focuses on treatment of side boundaries as permeable periodic boundaries, and then covers in detail the polar annulus and 3D Cartesian and spherical geometries. The chapter mentions two ways of treating absorbing boundary conditions; by gradually increasing the viscous and thermal diffusivities with distance away from the region of interest, or through Rayleigh damping. The equations and solution strategies for annulus and full 3D spherical shell geometries are discussed in great detail.

Part 3 covers advanced topics of magnetic field, density stratification and effect of rotation. This section deals with more advanced topics such as MHD simulations, anelastic models and rotation. The chapter introduces magnetoconvection and then reviews the MHD equations. The magnetic induction equation is derived from the Maxwell’s equations and then a problem of magnetoconvection in a box in the presence of a vertical background magnetic field is discussed. Similar to the hydrodynamic convection, critical Rayleigh number for magnetic case and equation for internal gravity waves are derived. The analysis is extended to magnetoconvection in the presence of a horizontal as well as arbitrary background fields. Further, the nonlinear MHD simulations are discussed.

The Boussinesq approximation is not valid for the convective interiors of planets and stars having large density variations. The chapter on density stratification introduces anelastic and pseudo-compressible approximations and presents equations for 2D Cartesian box and 2D cylindrical annulus geometries for anelastic approximation. Numerical treatment of these equations, linear stability analysis and nonlinear simulations are then discussed. The last chapter introduces the effect of rotation on convection and MHD dynamos. The Eulerian time derivative of velocity for rotating frame is presented and the concept of geostrophic flow is introduced. Two more important non-dimensional numbers, the Ekman number and the Rossby

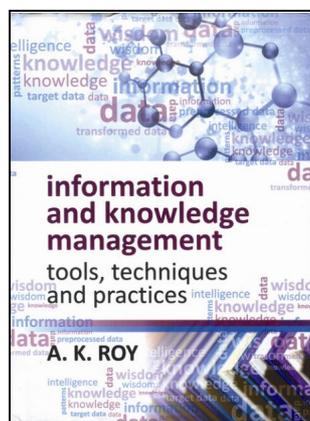
number are defined here. The chapter ends with full 3D rotating spherical shell geodynamo simulations and lists a number of significant problems related to planetary and stellar dynamos that should be addressed in the future.

The book contains five appendices describing codes for tridiagonal matrix solver, Legendre functions and Gauss quadrature and storing movie files, and simple directives for parallel programming environment. In addition, movie files for simulations discussed in the book are available online at <http://es.ucsc.edu/~glatz/book>. The website lists one erratum in eq. (10.8): ‘The signs on the two terms on the right need to be reversed.’

In summary, the book is a valuable asset for undergraduate and graduate students as well as early career researchers in this field and would be extremely useful for classroom teaching.

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**Information and Knowledge Management: Tools, Techniques and Practices.** Ajit K. Roy (ed.). New India Publishing Agency, 101, Vikas Surya Plaza, CU Block, LSC Market, Pitam Pura, New Delhi 110 034. 2013. xiv + 665 pp. Price: Rs 2450.

‘The basic economic source is no longer capital, nor natural resources nor labor. It is and will be knowledge.’ This quote by Peter Drucker aptly sets the context to

understand the relevance of the topic discussed in this book. The first section of the book uncovers the fundamentals of knowledge management in three chapters by Alivelu *et al.*, Subudhi and Roy respectively. While Alivelu *et al.* decode the DIKW (data, information, knowledge and wisdom) pyramid and introduce us to the tenets of data mining, Subudhi takes us on a through knowledge management and the changing need of IT applications and leaves us with an alert that the technology is abundant from wired-cables to cloud computing and we all should be prepared to adapt to it.

Acknowledging the insights shared by Rabi, Roy unearths the trends of knowledge management practice. A description of Nonaka and Takeuchi processes converting the tacit and explicit knowledge brings out the nuances of mastering the knowledge bases. The urgency to bridge the knowledge gap is aptly brought out by Roy as he states: ‘The efficiency of a firm depends on how fast it bridges the gap between what it knows and what it needs to know.’

An introduction to the new roles identified in knowledge management research such as knowledge engineer, knowledge editor, knowledge brokers, knowledge shepherds, knowledge gatekeepers, knowledge navigators, knowledge asset managers and chief knowledge officers inspires us with the opportunities that lie ahead of organizations to build robust knowledge management departments. Read this chapter to understand what it takes to identify talent in knowledge management and develop it for organizational results.

An insight into the National Knowledge Commission’s (NKC) vision and the emphasis on knowledge management in the Eleventh Five Year Plan (2007–2012) highlights the extensive roadmap for our future. The recommendation of Sam Pitroda (Chairman, NKC), and the action taken as follow-up on the NKC recommendations exhibit that we as a nation are moving in the right direction to make knowledge management one of our core strengths for growth and development. The plan to set up a National Knowledge Network (NKN) to interconnect all knowledge institutions in the country with gigabit capabilities for sharing resources and research, stands out as a big milestone to be achieved.

Also, a discussion on innovation in knowledge management practices in