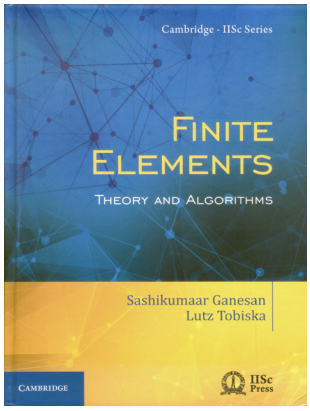

Finite Elements: Theory and Algorithms. Sashikumaar Ganesan and Lutz Tobiska (eds). Cambridge–IISc Series. Cambridge University Press, University Printing House, Cambridge CB2 8BS and IISc Press, Bengaluru. 2017. viii + 208 pages. Price: Rs 495.

Finite element methods (FEMs) is an important area in numerical analysis of partial differential equations (PDEs). In modern scientific computing, FEMs has gained popularity in approximating the numerical solutions of PDEs. Historically, though this method originated in solid mechanics, subsequently it has enjoyed tremendous success in a variety of applications, including fluids, plates, time-dependent problems, etc.

This book is written in a reader-friendly manner and can serve as a reference book for the first course in FEMs. It contains nine chapters covering weak formulation of elliptic PDEs, finite element construction and the interpolation theory, approximation of biharmonic problem, parabolic problem, linear elasticity, Mindlin–Reissner plate, Stokes and Navier–Stokes problems, and some algorithmic aspects of implementation.

Chapter 1 of the book begins with an introduction to Sobolev spaces and mentions some notions from functional analysis and proving the Banach contraction principle. The definition of weak derivative and Sobolev spaces are introduced; the statements of Sobolev imbedding theorem and the trace theorems are included with appropriate references for the proofs.

In chapter 2, weak formulation is introduced and the well-posedness of the elliptic scalar problem is proved. This chapter motivates the weak formulation for setting up an abstract framework for the Lax–Milgram lemma, which guarantees the existence and uniqueness of a weak solution to the elliptic problem. The lemma is proved and its use is illustrated with examples of Laplace equation and a convection–diffusion-reaction equation. It closes by introducing the standard Galerkin method and proving the fundamental Cea's lemma yielding the quasi best approximation for the Galerkin method.

Chapters 3 and 4 are devoted to the finite element construction and the interpolation theory respectively. The popular Lagrange finite elements on simplicial and cubical meshes are discussed in detail and the construction of global finite element spaces is described by following a necessary result to glue the local shape functions. The concept of mapped elements and a brief discussion on isoparametric finite elements are included to make the reader familiar with the forthcoming difficulties in implementation. Serendipity element, Argyris triangle and Bells triangles are some of the more popular examples included in the discussion. The interpolation theory is an important subject to understand the approximation properties of finite elements. The fundamental tools in this are Bramble–Hilbert lemma, change of variables with affine transformations and appropriate interpolation operators. The discussion and technical details are clearly presented with appropriate references, whenever required. Aubin–Nitsche duality argument to improve the L^2-norm error estimate is explained in detail. Some discussion on Scott–Zhang interpolation for less smooth functions is added.

Chapter 5 discusses the approximation of Biharmonic equation by classical C^1 conforming and nonconforming FEMs that include rectangular Adini element, triangular Morley element and a nonconforming tetrahedral element. It is well known that as the implementation of C^1 finite elements is complicated, classical nonconforming FEMs became attractive. It is necessary to understand these methods from both theoretical and practical points of view. Readers interested in fourth-order problems and nonconforming methods will surely benefit from the discussion in this chapter.

Chapter 6 deals with the numerical analysis of parabolic problems using FEM in space variables and various discretizations in time variable. The discussion on A-stable and L-stable methods is precise. The time discretization includes the backward Euler method, Crank–Nicolson method, fractional step θ-method and Galerkin method. The chapter features a well-structured discussion on operator splitting techniques for high-dimensional problems. Chapter 7 presents a brief discussion on finite element approximation of linear elasticity problem and Mindlin–Reissner plate. The finite element approximation of Stokes and Navier–Stokes problems is discussed in chapter 8. The weak formulation of Stokes problem and its well-posedness through Ladyzhenskaya–Babuska–Brezzi condition are outlined. Conforming and nonconforming discretizations that are inf-sup stable have also been discussed. A brief section on equal-order stable approximation is added to facilitate the state-of-the-art discussion in the literature.

Without implementation of FEMs, there is no true sense of numerical analysis, be it in industrial or academic research. In chapter 9, the authors provide from their practical experience, description of algorithms that are useful to write the codes for implementing FEMs. This includes various discussions on mesh-handling, assembly, boundary conditions and solvers, etc.

The bibliography covers most of the classical monographs and research articles.

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Annual Review of Public Health, Vol. 38. Jonathan E. Fielding, Ross C. Brownson and Lawrence W. Green (eds). Annual Reviews, 4139 El Camino Way, P. O. Box 10139, Palo Alto, California 94303-0139, USA. 2017. xii + 563 pages. Price: US$ 101.

When I scanned the contents of this edition of the *Annual Review of Public Health*, my attention was immediately drawn to the article by Peter Craig *et al.* entitled 'Natural experiments: an overview of methods, approaches, and contributions to public health intervention

research'. Natural experiments, as defined by the UK Medical Research Council, include those events that are not under the control of the researcher that divide a population into exposed and unexposed groups. Such experiments have been with us for a very long time indeed. John Snow's documentation of cholera in London and the closing of the Broad Street pump is a classic example of a natural experiment. In their review, the authors cite a varied range of natural experiments which include the effect of pesticide bans and suicide in Sri Lanka, the repeal of handgun laws on firearm-related murders in Missouri, the effect of traffic policing on road traffic accidents in Oregon, and of anti-tobacco laws on tobacco consumption in California, USA, among others. This article is particularly important for all those involved in public health on at least two counts. First, we are constantly being subjected to natural experiments in the form of laws, bans, pricing of goods, etc. We owe it to ourselves to understand the impact of such actions. Second, not all public health interventions are amenable to randomized control trials, often seen as a 'gold standard' for the evaluation of interventions. Natural experiments are imperfect interventions as a research method and are replete with potential confounders. This article is, therefore, particularly pertinent because it describes the varied approaches available for evaluating natural experiments, and discusses the advantages and disadvantages of each approach.

The first section of the *Annual Review* is devoted to epidemiology and biostatistics, and has several important methodological articles related to 'Bias analysis for uncontrolled confounding in the health sciences', public health surveillance and research and evaluation designs for dissemination and implementation. These articles are essential for the public health researcher and practitioner.

The article by Valente and Pitts entitled 'An appraisal of social network theory and analysis as applied to public health: challenges and opportunities', is an especially topical issue given the reach and use of social networks in society. The authors discuss, among other issues, the measurement of network influences and the role of networks in evaluating health interventions. As outlined by them, social network theory has been applied to a large number of areas of health research, including physician behaviour, adolescent risk-taking, obesity and physical activity, and community-based participatory research, among others. The opportunities of this area of research are enormous as evidenced by a growing mass of the literature related to this topic. Importantly, the authors also address the issue of ethics in this situation. They raise the concern of privacy and anonymity of data, the lack of consent, the unintended effects of on-line experimental manipulations and the potential harms of privacy loss to participants. The potential benefits of this form of research must clearly be weighed against possible harm.

The concern about non-communicable diseases continues to be reflected in a number of articles. While the issue of obesity has found its place in the *Review* in recent years, obesity-related articles in this particular edition are especially relevant and welcome in an Indian context. Nicole Ford *et al.* focus on the burden, drivers and emerging challenges of obesity in low and middle-income countries. The situation is different in low-income countries compared to more affluent countries in that there is a dual burden of undernutrition and obesity, as also differences in the income gradients in obesity, gender differences and the impact of urbanization. The drivers for obesity that are discussed include the nutrition transition, global trade and the food environment, and declining physical activity levels. Other risk factors that are discussed include genetic and epigenetic influences, the effect of early-life undernutrition, the gut microbiome and enteric infections and the influence of environmental contaminants. The authors highlight data gaps that impair obesity prevention and management efforts. Among these, are the lack of surveillance systems to monitor prevalence and impact of obesity. This data gap fits in well with a related article on 'Surveillance systems to track and evaluate obesity prevention efforts' by Hoelscher *et al.* Also relevant to the Indian context is an article by Palmedo *et al.* entitled 'Countermarketing alcohol and unhealthy food: an effective strategy for preventing non-communicable diseases? lessons from tobacco'. The idea of countermarketing is to expose and counter the practices that industry uses to sell unhealthy products. Utilizing the extensive experience of the anti-tobacco campaigns, the authors outline a comprehensive array of measures that can be used to address marketing of alcohol as well as unhealthy food. This lucid and instructive article is an essential read for everyone, not just those who are public health activists or who are at the forefront of health promotion.

The section on environmental and occupational health is understandably dominated by two major themes that should engage all of us on this fragile planet, namely the issue of climate change, and exposure to environmental pollutants and contaminants. Newspapers and other media have of late been highlighting the problem of added deaths attributable to indoor and outdoor pollution, and of rising CO_2 levels as a part of climate change. We are increasingly being exposed to environmental pollutants, some in small but, nonetheless, significant quantities. From this has emerged the idea of the 'exposome', i.e. all environmental contaminants that a person experiences from conception through the entire life cycle. In this review, three articles focus on the exposome. In the first, Turner *et al.* review the state of the science for assessing external exposures in terms of categories of exposures, available tools and research needs. Manrai *et al.* discuss the science of analysing the human exposome while focusing on the data-centred challenges. Finally, Stingone *et al.* make a strong appeal to the research community to move on from single environmental exposure studies to implement an exposome research paradigm within the field of environmental epidemiology.

Issues in public health practice and policy are addressed in a set of interesting articles. In 'Evaluating the health impact of large-scale public policy changes: classical and novel approaches', Basu *et al.* supplement the article on natural experiments, by addressing three major issues – first, how to distinguish a policy effect from regular time trends; second, constructing a comparison population when well-matched controls do not exist, and third, addressing the perplexing issue of unobserved confounders. Basu *et al.* open their article with a particularly apt quotation of Rudolf Virchow – Politics is nothing else but medicine on a large scale!. Erwin and Brownson in their article 'Macro trends and the future of public health practice', address how forces of change such social media and informatics, demographic

transitions, globalized travel and climate change, among others, affect the context in which public health systems operate. One trend that I thought particularly relevant to incorporate in India is the notion of 'Health in All Policies' (HiAP). This idea recognizes that policy decisions outside health impact the determinants of health as well. The implication is that public policies in all sectors should take into account the health and health system implications of the decisions that they make. This would avoid harmful health impacts of decisions made in other sectors.

Trauma care still has a long way to go in the developing countries in terms of quality, access and outcomes. The article by Reynolds *et al.* on 'The impact of trauma care systems in low- and middle-income countries', is therefore important. The authors assess a range of interventions across many countries, including India, and suggest several priority areas for research, programme development and funding.

I found myself engaged by the issues and articles of this volume of the *Annual Review of Public Health*. The articles are topical and hold a particular relevance to people across the world, including India. I am sure that this volume will be appreciated by researchers, public health practitioners and public health activists.

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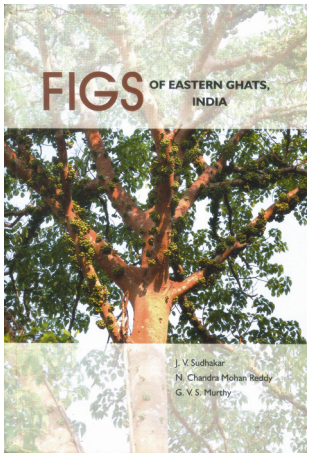

Figs of Eastern Ghats, India. J. V. Sudhakar, N. Chandra Mohan Reddy and G. V. S. Murthy. National Biodiversity Authority (NBA), Chennai. 2017. xiv + 149 pages. Price: Rs 600.

Fig trees (*Ficus* spp.), one among the world's oldest trees, traced back to the earliest historical documents are considered sacred in many ancient civilizations and cultures. Figs symbolize knowledge, enlightenment, passion and fertility. They are considered as keystone species and in tropical and subtropical regions, an ecosystem has developed surrounding these trees. During flowering, a full-sized fig tree is visited by more than 2000 birds per day. The co-evolution of wasps with figs is an enchanting biological drama.

The Eastern Ghats is a broken necklace in India's physiography and is one of the least explored natural landscapes of the country. In this book, the authors have made an intensive and comprehensive study on the morphology of 27 wild and 10 planted fig species. They have compiled and documented the figs of Eastern Ghats in a systematic manner with excellent photographs arranged in an orderly fashion. The authors have also organized the habit, morphology, economic, religious and medicinal importance, propagation techniques, pollinators, pollination mechanism in both monoecious and dioecious fig species in a single book. The information provided in this book will be extremely beneficial to botanists, scientists, researchers, environmentalists and students.

The book serves to educate people not only on the wealth of biodiversity in a region like the Eastern Ghats, but also of the necessity to empower them for the protection of the environment. A deep commitment towards conservation of the ecosystem runs throughout this book.

Multi-head Ficus microcarpa cultivar

However, there is an ambiguity regarding the status of these plants. For example, *Ficus benjamiana* is considered wild here, but it is a planted species. Also, it is suggested that a compound key for all species (wild and planted) will be more useful, as the user is ignorant about its habitat. A comparison with figs of the Western Ghats in the book *Flowering Plants of the Western Ghats* by Nayar *et al.*[1] may be useful here. Nayar lists 34 wild and 8 cultivated species, among which are exclusively from the Eastern Ghats. The strengths and weaknesses of this book have been pointed out by Madhav Gadgil in his foreword.

1. Nayar, T. S., Rasiya Beegam, A. and Sibi, M., *Flowering Plants of the Western Ghats*, Jawaharlal Nehru Tropical Botanic Garden and Research Institute, Palode, Thiruvananthapuram, 2014.

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