This book provides a welcome and very useful overview of the technologies, which have breathed new life into a very long-established experimental stress analysis technique. Prof. Ramesh has successfully drawn together much of the literature on the various aspects of digital photoelasticity, along with relevant technologies which complement it or provide promise for its future development. All this is evidently written in the light of his considerable experience within this field and incorporates substantial input from his research.

The main text begins in Chapter 1 with an overview of transmission photoelasticity, and lays the theoretical foundations for the concepts and analysis in the remainder of the book. After a brief example of trigonometric resolution as an analysis method, Jones calculus is introduced as the main analytical notation. While I have no problem with this, I was slightly surprised that Stokes vectors and Mueller matrices merited no mention as a widely used alternative. The theoretical foundations are supplemented by a discussion of photoelastic materials and their calibration, together with discussions of the properties of fringes and a brief discussion of 3D photoelasticity. Chapter 2 examines in some detail the theoretical and practical issues surrounding reflection photoelasticity. Chapter 3 then begins the examination of the digital aspects of photoelasticity with an overview of digital image processing concentrating on monochrome images. This discussion is rather general and covers image capture and display, mathematical operations on images, e.g. the use of spatial filters of various types, edge detection and other general image-processing topics. There is some emphasis on specific examples of the hardware used for image capture.

The next three chapters concentrate on assembling the component technologies to form digital photoelasticity as a system. Chapter 4 focuses on fringe-based digital photoelasticity techniques, in particular fringe multiplication, thinning and clustering, with descriptions of the algorithms used. Chapter 5 very usefully reviews the range of phase shifting, polarization stepping and Fourier-based approaches used for point and full-field measurement, and provides good comparison of many of the numerous algorithms published in this area. The important topic of unwrapping of the resulting phase maps and the use of 'tiling' to examine regions of steep fringe gradients are both examined in Chapter 6, although a fuller discussion or evaluation of alternative unwrapping algorithms would have strengthened this already useful chapter.

Chapter 7 then re-examines imaging technology with an emphasis on colour image processing techniques. There is some overlap with Chapter 3 on the general topics considered, but the main emphasis here is on techniques based on colour filtering and matching such as three-fringe photoelasticity and spectral contents analysis as well as a brief discussion of phase shifting in the colour domain, hybrid techniques and the tricolour photoelasticity method.

The next two chapters concentrate upon the interpretation of the photoelastic results. Chapter 8 involves the evaluation of contact and fracture parameters by fitting to photoelastic data, while Chapter 9 reviews a variety of methods for stress separation ranging from generic techniques such as those of Frocht and Tesar to more complex numerical techniques including the use of the finite element method.

The last two chapters depart to some extent from the specifics of digital photoelasticity to review various enabling technologies and possible future developments. Chapter 10 assesses the relationship of digital imaging photoelasticity with rapid prototyping and rapid tooling technologies, with some emphasis on outlining those technologies themselves. Chapter 11 completes the book by considering recent developments and future trends, with particular emphasis on evaluating the characteristic parameters of 3D models, dynamic photoelasticity including high-speed image capture and the application of photoelasticity to orthotropic materials.

The book is accompanied by a CD-ROM of the C source code of the programs referred to in the text along with some photoelasticity simulations and some hardware-specific code. The text is supported by ample
end-of-chapter tutorial questions although no answers are given. The target readership would appear to be biased more towards academics, researchers and final-year undergraduates rather than industrial practitioners.

Overall, the reviewer found the book very informative and reasonably comprehensive, and a welcome addition to the literature on photoelasticity. The standard of writing is high and the vast majority of the explanations can be clearly understood. There are occasional minor lapses in grammar but these do not detract from the readability or sense of the book. In one or two places, however, arguments are begun but are left insufficiently developed to fully understand their practical implications. There are one or two omissions which might surprise researchers attempting to get involved in the area. For example, there is ample coverage of camera and frame-grabbing hardware yet no proper mention of choice of suitable lenses, and the only significant discussion of light source design is in the context of tricolour photoelasticity. Similarly, the electromechanical design of a digital polarscope is not really covered beyond a brief mention of stepper motors. Conversely, some of the material covered (e.g. rapid prototyping and some of the material on digital imaging processing) is interesting background but does not really contribute to the main thrust of the book. These criticisms are, however, relatively minor and do not affect the overall verdict as a very useful (possibly even essential) introduction and reference book for those researching, teaching and studying in the area of digital photoelasticity.

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