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European Journal of Mechanics B/Fluids 21 (2002) 493–494



## Book reviews

### **Schlieren and Shadowgraph Techniques: Visualizing Phenomena in Transparent Media**

G.S. Settles (Springer-Verlag, Berlin, Germany, 2001)

The problem with most encyclopedia is that you find a little about everything, mainly nice pictures. However, each time you have a specific problem you do not find the precise quantitative information that you are looking for.

The good news about the book of Settles is, that it is a monograph. There is a lot of detailed information about the schlieren and shadowgraph methods combined with very nice pictures. In the second edition, it would be nice to have all these pictures on poster format rather than A16.

One could argue that schlieren and shadowgraph are simple, well-known, 19th century techniques. Why would they deserve a monograph in the 21st century?

Firstly, any person that tried to make the kind of schlieren quality reached by Schardin (book cover) knows that high-quality flow visualization is an art. You need a master to teach you the art.

Secondly, you will discover that recently smart people, like Weinstein, succeeded in making in-flight schlieren pictures of the flow around an aircraft and that Settles has developed a set-up to make schlieren pictures for a full-scale tractor!

In this book the master provides you with a systematic and straightforward discussion of the theory (Chapters 2 and 3), an overview of recent developments (Chapter 4) and an excellent practical guide (Chapters 7 and 8). This bulk of the book is topped of by an entertaining survey of the history (Chapter 1) and inspiring examples of applications (Chapter 9).

In comparison, Chapter 10 on quantitative evaluation is quite short. It should be extended in a second edition.

How could I summarize? I have recently borrowed the book to a friend involved in research on the Marangoni effect. He wanted to build a schlieren set-up. His reaction was: “you saved me six months of hard work!” This book should be in all fluid dynamics laboratories, but you will enjoy having your own copy. I am happy with mine.

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S0997-7546(02)01191-3

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### **Computational Methods for Environmental Fluid Mechanics**

O. Kolditz (Springer-Verlag, Berlin, Germany, 2002)

The present book is concerned with flows in porous media considering the aspects of heat transport, variable density, multiple phases and fractured media. Strong emphasis is given to the numerical methods and programming techniques oriented to the solution of the mentioned problems. The book consists of fifteen chapters gathered into four parts: continuum mechanics, numerical methods, software engineering and selected topics.

The first three parts have a final list of references while in the fourth part each chapter (4) has its own bibliography. Seven of the fifteen chapters present at the end a list of problems; these, however, pose additional theoretical questions or ask for proofs rather than proposing numerical applications of the explained concepts. At the end of the book an alphabetical index is provided with a list of the most important topics.

Chapter 1 opens the book with the standard fluid dynamics background up to the conservation and balance equations for mass momentum and energy. Chapter 2 gives a very short description of turbulence; this however should be regarded as an invitation to read more specialized textbooks for further details.

Chapter 3 reconsiders the conservation and balance equations for porous media, therefore separating the contributions of fluid and solid phases. Chapter 4 gives a mathematical classification of partial differential equations and comments on the physical meaning by some examples. Chapter 5 opens the second part with the basic properties of numerical methods and the description of some method classes. Chapters 6, 7 and 8, respectively, introduce finite-difference, finite-element and finite-

volume methods showing the background theory and some example applications. The third part starts with Chapter 9 on object-oriented methods for hydrosystem modeling in which the physical problem is split into different object categories. Chapter 10, on the other hand, provides object-oriented programming techniques giving examples for the object implementation and external interface. Chapter 11 is very short and explains how to implement the finite-element method within the framework of object-oriented programming. The last part contains selected topics and Chapter 12 describes nonlinear flow in fractured media; theory, governing equations and numerical procedures are provided together with a discussion of the most relevant effects.

Chapter 13 extends the previous chapter to the heat transport starting from the governing equations up to the description of simulation results for benchmark problems. Chapter 14 replicates the organization of the previous chapter for variable density flows. The final chapter deals with multiphase flows in deformable porous media. In addition to theory and equations this chapter explains the finite element formulation and the implementation for these problems together with programming details and benchmarks.

The book is extremely specialized in computational fluid dynamics for fractured and porous media and it could be a valid text for the researchers involved in the field. Although the applications reflect the personal research experience of the author, enough material is provided to extend the theory to different numerical methods or applications. Considering that the intended reader for this book is a researcher or, at least, an advanced graduate student, I have found the presentation of the material inhomogeneous since some chapters are at a too elementary level (for example, Chapter 2) and others of marginal relevance for the subject of the book (as Chapter 4). The figure quality is barely enough since the gray levels are unreadable and using dumped computer windows is not a good idea owing to the unnecessary window frame, and the very small fonts which make the figures difficult to read. As a final comment I believe that the title of the book does not reflect its content and this might prevent potential interested readers from consulting it.

The purchase of the book is advised to researchers and department libraries involved in the field.

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