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BOOK REVIEW

M. KAVIANY, **Principles of Convective Heat Transfer.** Springer, Berlin, 1994, xxii + 709 pp.

This monograph represents a significant attempt by an active and well-known researcher to present a unified and concise treatment of the growing and important field of convective transport. The book is part of Springer's Mechanical Engineering Series, which also includes an earlier book by the same author on heat transfer in porous media. The author has tried to link the treatment of the convective phenomena in many different fundamental and applied areas, focusing on the underlying mechanisms that govern the flow and the associated heat and mass transfer. It is a very formidiable task, since there has been a very substantial expansion in our knowledge of convective transport in recent years and different concerns have led to a wide variety of formulations, treatments and results. The author is to be congratulated in trying to bring all these different approaches together in a unified manner. Such an effort has its negative side in that it is difficult to cover any major area to the desired level of detail and to present results that may be readily applicable to problems of practical concern. I would have preferred to see a few major and emerging areas covered to greater depth. But the author has successfully treated important questions in a fundamental and authoritative manner, so that the book would serve as an important reference for a wide range of areas in which convective transport is of interest.

The monograph starts with a chapter on introduction to the subject. This chapter provides the background on the three phases of matter, phase transitions, approximations, modeling, conservation equations, averaging and other relevant basic issues. It also presents the scope of the book, an interesting historical perspective and current and future trends in this field. This chapter is a useful starting point and forms pleasant reading. The remainder of the book is divided into three main parts concerning single-, two- and three-medium treatments. Though other subdivisions are obviously possible, this is a fairly useful and concise way of approaching the subject. In single-medium treatments (Part I), single- and two-phase systems are considered. The former concerns different mechanisms and aspects such as radiation, electro- and magnetohydrodynamics, buoyancy, turbulence, compressibility and reacting flows. The basic treatment and some important results are presented. This is an extensively studied area because of its simplicity and importance. Similarly, two-phase systems are considered, with the system represented as an effective, single medium. The two phases are assumed to be in local thermal equilibrium. Circumstances of solid–fluid systems with stationary solid, which apply for porous media, as well as of the two phases moving are considered. Dispersion, averaging, exothermic reactions, phase change and other relevant aspects are presented. The focus is on the approximations and the basic formulation.

Part II considers solid–fluid systems with simple, continuous and discrete interfaces, as well as fluid–fluid systems. These are circumstances where two-medium approaches are necessary. Continuous interfaces have been studied extensively in the literature and the book presents the treatment and specific results. The effects of viscosity, turbulence, surface roughness, compressibility, nonNewtonian fluid behavior, surface injection, buoyancy, chemical reactions, etc. are considered. Similarly, dispersed-phase elements, porous media and particulate flows are considered. Liquid–liquid, gas–liquid, and gas–gas systems, bubbles and droplets form the subject of fluid–fluid systems involving two-medium treatments. Several interesting problems are considered and typical analysis and results presented. The last part of the book presents the more complex topic of three-medium treatments, considering solid–solid–fluid and solid–liquid–gas systems. The former includes topics like particulate flow around solid surfaces, fluidized beds, and dendrite and layer growth in solidification. The last chapter considers vapor and liquid films, surface bubble and droplet formation and dynamics, impinging droplets, contact angles and contact lines, due to the presence of all three phases, and other related phenomena. Several of the topics considered have not received much attention in the literature and it is good to see them included. However, some important topics like nonNewtonian flows are not discussed in adequate detail. This is not surprising because of the broad coverage of the book.

Overall, it is a well-written book. An errata is available to take care of various typographical errors. The material chosen and the depth of coverage do reflect the research interests of the author. However, a strong effort has been made to include most significant issues and problems in convection. The level of the treatment is somewhat advanced and the book will be appropriate for graduate students and researchers interested in this field. It is clearly a monograph and no attempt is made to cast it as a textbook. But it can certainly be used as a reference book in a few advanced courses such as those on combustion, materials processing, and environmental heat transfer. It is, therefore, highly recommended as a reference book in convective transport.

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