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BOOK REVIEW

Multiphase Fluid Dynamics, by S. L. Soo. Science Press/Gower Technical, Beijing/Sydney (1990).

This monograph represents the second edition of the previous book *Fluid Dynamics of Multiphase Systems* published in 1967. As compared with the previous edition, one new chapter has been added and some minor changes introduced in five others. The theme of the book is the highly elaborate field of multiphase fluid dynamics—an interdisciplinary branch of the science which is related to various important applications.

Some of the systems exemplifying the multiphase fluid dynamics as well as their physical properties (size distribution etc.) are discussed in the Introduction.

Chapter 2, entitled " Transport processes of a rigid particle", deals with the consideration of the main forces acting on a single particle (or a droplet) in a fluid flow. The influence of gravity, acceleration, vorticity, pressure and temperature gradients is considered in this chapter. The motion of a single rigid particle in a turbulent flow is described and the turbulent diffusivity of a particle is predicted.

Chapter 3, entitled "Transport processes of a deformable particle", deals with such basic problems as the formation of droplets and bubbles and their motion as well as heat and mass transfer through a phase interface.

Collective modes corresponding to multiphase systems are considered in Chapter 4, "Transport properties of a cloud of particles". Special attention is paid to the collisions of the particles in flows and to the resulting transport processes. Some classical elements of suspension rheology are considered in this chapter also. In a new section, erosion and attrition of solid surfaces in contact with suspension flow are discussed, which represents a very important theme rarely included in "multiphase" texts.

Chapter 5 deals with the electrical effects: charging of particles and a modification of their motion under the action of electrical forces.

The key element of the book is Chapter 6, entitled "Basic equations of multiphase systems", where the concept of interpenetrating continua is introduced and the governing equations of hydrodynamics of multiphase media are obtained. The continuity, momentum and energy equations obtained in this chapter create a basis for the solutions of particular problems considered in the following chapters.

One of the above-mentioned problems is related to suspension flow through a nozzle, which represents a classical quasi-one-dimensional situation. This problem is considered in Chapter 7. General questions on the stability of solutions of one-dimensional problems are included in this chapter also. The conditions of well-posedness and ill-posedness are obtained for various multiphase flows. This is very important material elucidating the physical sense of the continuum representation of dispersed systems and corresponding restrictions.

In Chapter 8 the pipe flows of a suspension are considered. For turbulent flows the main empirical correlations for friction, heat and mass transfer in pipes are given, together with some detailed information on the pressure, concentration and velocity fields in pipes.

Chapter 9, entitled "Hydrodynamics of a suspension", deals with some traditional aerodynamical problems modified by the particle presence. Namely, a particle motion in a swirling flow, a laminar boundary layer over a flat plate as well as channel and submerged jet flows.

In the final chapter, the sedimentation and dynamics of fluidized beds are considered. For the latter, instability and bubble formation problems as well as the rheological behavior of a granulated medium are discussed.

The field of multiphase flows is very extended. Maybe this is the reason why some important topics are beyond the scope of the present monograph. Among them are such problems as combustion and chemical reactions in multiphase flows (discussed very briefly) and flows with predominant thermophoresis, which have been studied in the last decade and form the basis of many modern technologies.

The consideration of liquid atomization does not include any modern idea or result.

The studies of non-Newtonian rheological behavior of suspensions of particles in liquids are not considered in the present monograph, nor are any of the theories of the influence of suspended particles on turbulence structure and transport.

The important numerical results on the sedimentation of finite dimension clouds obtained recently are not considered in the corresponding chapter.

The studies on entrainment of various bodies by gas–particle and gas–droplet flows represent themselves as an interesting and important field of the modern theory of multiphase flows. Unfortunately, only one preliminary paper devoted to this problem is mentioned in the monograph.

The part devoted to boundary layer flow does not contain any discussion on a particle uplift behind shock waves moving along a ground surface.

The consideration of fluidized beds does not include any modern results about quicksand media which may be transferred into a fluidized state when subjected to rapid straining in flow. Such phenomena take place in numerous technological processes (vibromixing, vibrocrashing, conveying etc.).

The consideration of acoustic wave propagation in suspensions and bubbly liquids does not include many modern results on the influence of interphase non-stationary effects on dispersion and dissipation of disturbances.

Studies of the dynamics of particles, bubbles, suspensions and gas–liquid systems under the action of vibration in sonic fields, which are of engineering importance, are not discussed in the present monograph.

The survey of the studies of shock wave propagation in multiphase media limits itself to some preliminary papers. The studies on unsteady propagation of long and short shock waves in suspensions and their reflection from the obstacles are not considered. Shock wave enhancement in liquids with gas and vapor bubbles and shock wave attenuation in solid and liquid foams are not considered, nor is blast wave propagation in such media.

These shortcomings may be a result of the fact that the list of references of the book is not up to date. We found only one reference dated 1981, and this is the most recent one in the present monograph.

Nevertheless the book may be useful as a basic text on multiphase flows. It may be used by students, engineers and researchers specializing in this field.

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