Statistical Fluid Mechanics (in Russian), 2nd Russian edition, by **A. Monin, A. Yaglom** (Gidrometeoizdat, St. Petersburgh, vol. 1: 1992, vol. 2: 1996, vol. 1: 694 pp., vol. 2: 742 pp.) hc vol. 1: ISBN 5 286 00857 7, vol. 2: 5 286 00858 5

This is the second *Russian* edition of the encyclopaedic book on turbulence, the first English edition of which was published by MIT Press in 1971, Vol. **1** and in 1975, Vol. **2**.

This review is mostly concentrated on the major changes made in the second edition. The readers interested in more detail are referred to the reviews by H. K. Moffatt (*J. Fluid Mech.*, **60**, *410-416 (1973)*) and H. Tennekes (*Appl. Mech. Revs*, **29**, book-6177, 1014 (1976)). All their appraisals and criticisms hold for this edition as well.

The structure of both volumes is mostly the same as in the first edition.

Volume **1** consists of five parts divided into eleven chapters:

Part I Laminar and turbulent motions: *1 – Equations of fluid dynamics and their consequences, 2 – Hydrodynamic instability and emergence of turbulence* [1];

Part II Mathematical mehtods of description of turbulence. Mean values and correlation functions: *3 – Methods of taking averages; fields of fluid dynamical characteristics as random fields, 4 – Moments of fluid dynamical fields; stationary random processes and homogeneous fields, 5 – Spectral representations of stationary processes and homogeneous fields* [2];

Part III Turbulent shear flows and semiempirical theories of turbulence [3]: *6 – Main classes of turbulent flows* [4], *7 – Equations for second moments* [5];

Part IV Turbulence in stratified media: *8 – Generalization of logarithmic boundary layer theory to thermally stratified flows* [6], *9 – Comparison of theoretical deductions with the data;*

Part V Particle motion in the field of turbulence [7]: *10 – The Lagrangian description of turbulence, 11 – Turbulent diffusion.*

Volume **2** consists of five parts divided into eighteen chapters:

Part VI Mathematical methods of description of turbulence. Isotropic and locally istropic fields: *12 – Isotropic random fields, 13 – Locally homogeneous and locally isotropic random fields;*

1. This chapter was totally rewritten.

2. This chapter was section 11 of chapter 6 in vol. 2 of the first edition.

3. Previously *Reynolds equations and semiempirical theories of turbulence.*

4. Previously *Turbulent shear flows in tubes, boudary layers, etc.*

5. Previously *The energy balance equation and its consequences.*

6. Two new sections were added to this chapter: *8.6. Vertical fine microstructure and 8.7. Stratified boundary layers.*

7. Previously *Particle dispersion in a turbulent flow.*

Part VII Isotropic turbulence: *14 – Equations for the correlation and spectral functions of isotropic turbulence, 15 – Final period of decay of isotropic turbulence* [8]. *16 – Self-preservation hypotheses, 17 – Spectral energy tranfer hypotheses, 18 – Millionshchikov's hypothesis, 19 – Equations for the higher order moments and the closure problem* [9], *20 – turbulence in compressible fluids;*

Part VIII Locally isotropic turbulence: *21 – General description of the local structure of turbulence at large Reynolds numbers, 22 – Dynamical theory of the local structure of developed turbulence, 23 – Experimental data on local structure of developed turbulence, 24 – Diffusion in the field of locally isotropic turbulence, 25 – Local structure of turbulence taking into account fluctuations of energy dissipation* [10];

Part IX Two-dimensional turbulence: *26 – Two dimensional turbulence, 27 – Geostrophic turbulence* [11];

Part X Functional furmulation of the turbulence problem: *28 – Equations for the characteristic functional, 29 – Methods of solving the equations for the characteristic functional* [12].

Three major changes were introduced in this new edition.

The first one is that Chapter 2 – *Hydrodynamic instability and emergence of turbulence* was fully rewritten. Some standard material on hydrodynamic stability has survived from the first edition, which was complemented by information on transition mostly in boundary layers. Three new sections (*2.5 Bifurcations, 2.7 Stochasticity and 2.8 Scenarios of stochastization,* total 21 pp.) contain some information on dynamical systems and temporal chaos and are based on the rewiew paper by *A. S. Monin, Hydrodynamic instability, Soviet Phys. Uspekhi, 29, 843-868, (1986).* Finally, two new short sections (*2.10 Begining of the theory of coherent structures,* 6 pp. and *2.11 Fractality of turbulence,* 5 pp.) are devoted to sketchy overviews of their subjects. There is not much justification for including in the chapter devoted to hydrodynamic stability these two last themes, which are never addressed in the book anymore. The latest references date 1990. The overall impression is that this chapter did not become better or more useful than before.

The second major addition is Part IX Two-dimensional turbulence: *26 – Two dimensional turbulence, 27 – Geostrophic turbulence.* It is based largely on two books on the subject: *A. S. Monin & R. V. Ozmidov, Turbulence in the ocean, XV, 247 pp., Reidel (1985),* and *V. M. Kamenkovich, M. N. Koshlyakov & A. S. Monin, Synoptic eddies in the ocean, X, 433 pp. Reidel (1986).* The material on two-dimensional turbulence is based on papers until 1978 (with the exception of one in 1983), whereas the geostrophic turbulence material ends in 1989.

The third change is in the last chapter in the book *29 – Methods of solving the equations for the characteristic functional,* which contains three new sections: *29.1 – Galerkin method* of solution of the Hopf equation (11 pp.), based on the book by *M. J. Vishik and A. V. Fursikov Mathematical problems of statistical hydromechanics, vii, 576 pp., Kluwer (1988); 29.3 – Application of methods of quantum field theory* (30 pp.) and *29.4 Use of renormalization group method* (16 pp.). The last two paragraphs were written by E. V. Teodorovich and provide an overview up to 1990.

Thus the revision made in the book is rather limited both as a whole and within the scope of the revised parts themselves. In justifying this the authors write in the preface that *during the last two decades many tens*

8. Previously *The simplest consequences of the correlation and spectral equations,* from which two paragraphs were moved to the previous chapter (*15.1 Balance equations for energy, vorticity* and *temperature fluctuations intensity and 15.2 The Loitsianski and Corrsin integrals).*

9. Here the section *Application of perturbation theory and the diagram technique* was removed (19.6 in the first edition).

10. Previously *Refined treatment of the local structure of turbulence, taking into account fluctuations in dissipation rate.*

11. In the first edition this chapter was followed by the chapter *Wave propagation through turbulence,* which was removed from the second edition.

12. This chapter was considerably changed.

of thousands of new works on turbulence appeared... With all the value of these works, they – as we think – did not change the principal basis of turbulence theory, presented in the first edition, which allows us to limit ourselves to the present second edition, instead of writing a new book (the time of which has not come yet, since the new mechanics of turbulence has not developed yet).

While it is easy to agree with the first part of their statement, the second part is hardly acceptable for several reasons. First, a number of books on turbulence appeared during the last two decades – the latest examples being *Turbulence, the legacy of A. N. Kolmogorov by U. Frisch, xiii, 296 pp. (Cambridge Univ. Press, 1995); Turbulence in fluids by M. Lesieur, x, 515 pp. (Kluwer, 1997,* third revised and enlarged edition); and though not formally a new, but updated, revised and enlarged last German edition of *Boundary Layer Theory by H. Schlichting and K. Gersten xxii, 851 pp. (Springer, 1997,* ninth edition). Second, a number of important developments occurred during the last two decades (including the 990-ies), which cannot be ignored just as a matter of taste. One of the examples most relevant to this book (Chapters 23-25) is the discovery and study of a number of "misbehaviours" of the small scale structure of turbulent flows (both velocity and passive objects) and several others.

From the technical point the main shortcoming is the absence of both author and subject indices.

This great book remained as great it was two decades ago, but it has undergone only minor updating and does not reflect the state of the field in a number of important aspects.

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