Preface to the 6th Edition

The present edition is the outcome of an extensive revision made, on the one hand, to bring its content closer to that of a textbook and, on the other, to update it by adding some new present-day problems.

Since it was impossible to extend any further so bulky a book as it was, some special sections dealing with the mechanics of liquids and gases but not fulfilling the objectives of the present general consideration had to be sacrificed. Thus, the problem of motion of multiphase media was dropped from the dynamics of inhomogeneous fluids, and only the derivation of the equations for multicomponent gas flows was retained as being closely associated with the description of the phenomena of dissociation and ionization of molecules in supersonic gas flows. Also omitted was the section dealing with the macroscopic approach to calculations of dust-laden gas flows which gave way to the methods of the kinetic theory of molecular motions. This was also the reason for dropping the section which discussed the shock wave from the viewpoint of continuum mechanics as well as some other problems dealt with in the previous edition of the book.

As distinct from previous editions where only vector and tensor calculus formulae were given, the present one provides a short background discussion on this area of mathematics. The section on the elements of similarity theory is supplemented with a presentation of dimensionality theory and with the proof of the main theorem in this theory.

Newly written are three sections dealing with some general methods for numerical integration of differential equations and their application to Navier-Stokes viscous fluid dynamics equations. Extensive revision of the chapter on turbulence culminated in the appearance of a new chapter dealing specially with the techniques for calculating turbulent boundary layers. Methodological blunders noticed in many places throughout the book have been eliminated.

Professor G. Yu. Stepanov, Dr. Sc. (Physics and Mathematics) read the manuscript with an exceptional accuracy and made a great number of scientific and methodological comments important for the quality of the book.

Professor Yu. V. Lapin, Dr. Sc. (Physics and Mathematics) read the manuscript of Chapter XIV and made a number of useful comments. An invaluable help in the work on the manuscript and in proof-reading was lent by Assistant Professor at the Chair of Hydroaerodynamics of Leningrad Polytechnic Institute S. B. Koleshko who not only undertook the scientific editing of the manuscript and made many useful remarks, but also wrote three sections (102–104) concerned with numerical solution of viscous fluid dynamics problems. The author regards it his duty to acknowledge cordially their assistance for this.