Preface

Experimental flow measurements, as the indispensable measure to investigate and improve engineering flows and flow processes, have been greatly advanced, as the laser methods have found applications in this area. Contrary to the traditional methods of using mechanical probes, the laser method obviously provides the most effective and accurate tools for non-intrusive flow measurements. Nowadays, the laser method for flow measurements has become very fashionable, mainly because of a lot of fashionable applications of laser techniques everywhere. The most widely applied laser methods for flow measurements are doubtlessly the laser Doppler anemometry (LDA), also known as the laser Doppler velocimetry (LDV), and particle image velocimetry (PIV). While the PIV method is suitable to quantitatively image the flow distribution, the LDA method is mostly applied to accurately diagnose and quantify all types of flows. The subject of treatment in the current book is the LDA method.

Since the first successful test of LDA principles, especially during the last 20 years, the LDA technique has been developed to be a high-level standard method for flow measurements. It has been acknowledged as being the most successful and widely applied measurement technique in both the scientific and engineering flow investigations. The advanced laser and computer technologies have greatly contributed to the development of advanced LDA technology. As a very effective and reliable measurement technique, the LDA method demonstrates its established significance not only in the field of mechanical engineering but also extensively in the fields of chemical and biological engineering, as well as in many other fields.

With regard to the uninterrupted developments of LDA technology up until now, it is worth noting that the majority of developments are mainly restricted to LDA principles under application of optics on one hand, and to improved soft- and hardware on the other hand. These developments lead to establishment of standard LDA instruments that have been commercial products and are easily obtainable for applications. Corresponding professional publications mostly concern the basic principle of the LDA method and the related developments named above. Only few investigations and developments have been conducted with regard to the integration of LDA optical facilities into flow mechanics. As has been perceived for a long time, it clearly lacks a supportive reference for LDA users in the practical applications.

The integration of LDA optical facilities into flow mechanics is designated as the LDA application methods. It stands for the methods to improve the optical conditions and to enhance the measurement accuracies. It also provides the guidelines for simplifying the measurements and correcting measurement errors as well as for clarifying the application limits and extending the application areas of LDA techniques. Based on corresponding developments in the last 15 years, the author of this book tries to summarize all important methods related to the aspects listed above and to make a useful reference for LDA users. As a practical reference, the book also contains all other basic knowledge of LDA technology. It is therefore suitable for all LDA users in universities, research institutes and industries. It also supports the further developments of both the hard- and software of LDA instrumentations.

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