

SUMMARY OF Ph.D. DISSERTATION

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Title Simultaneous Measurement of Fluctuating Velocity and Pressure in Turbulent Free Shear Flows		
Abstract <p>It is well known that the fluctuating pressure and the velocity-pressure correlation are fundamental statistics which reflect the vortical structure of turbulent flows. However, experimental studies on such quantities are rather limited due to the lack of appropriate experimental techniques. The focuses of the present thesis are to develop the technique for the simultaneous measurement of fluctuating velocity and pressure and to reveal the relationship between the vortical structure of turbulent flows and the pressure-related statistics.</p> <p>In chapter 1, the background and the previous researches related to the present work are shown and the scope of this thesis is clearly defined.</p> <p>In chapter 2, the effect of the fluctuating pressure and the velocity-pressure correlation is explained based on the governing equations. In addition, the several models of the pressure-related terms in the transport equations of the turbulent kinetic energy and the Reynolds stress are shown and problems in currently available models are described.</p> <p>In chapter 3, the technique for the simultaneous measurement of fluctuating velocity and pressure is presented. Either a static pressure probe (SP-probe) or a total pressure probe (TP-probe) is used with an X-type hotwire probe (X-probe). The fundamental performance of this technique is investigated and advantages and disadvantages of these two methods are presented.</p> <p>In chapter 4, the results of the measurement in the developing region of a turbulent mixing layer are discussed. The applicability of the SP-probe is confirmed from the fact that the present results agree with those of the numerical simulation with similar condition. In addition, the results obtained by the TP-probe agree with those of the SP-probe.</p> <p>In chapter 5, the results of the measurement in the wing-tip vortex are presented. The interference of probes using the SP-probe can be reduced by the use of the TP-probe. The present results indicate that the meandering of the vortex affects the distribution of the turbulence statistics including the fluctuating pressure, the velocity-pressure correlation and pressure-related statistics.</p> <p>In chapter 6, the conclusion of the present thesis is given. The combination of either the SP- or the TP-probe with the X-probe enables us to perform the simultaneous measurement of fluctuating velocity and pressure. It is shown that the distribution of the pressure-related statistics is strongly related to the vortical structure of turbulent flow in both simple and complex shear flows.</p>		