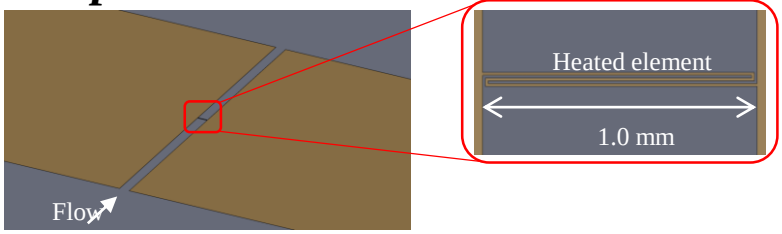
Simultaneous Measurement of Wall Shear Stress Fluctuation and Velocity Fluctuation in a Turbulent Jet

Osamu TERASHIMA
Department of Mechanical System Engineering, Faculty of Engineering,
Toyama Prefectural University

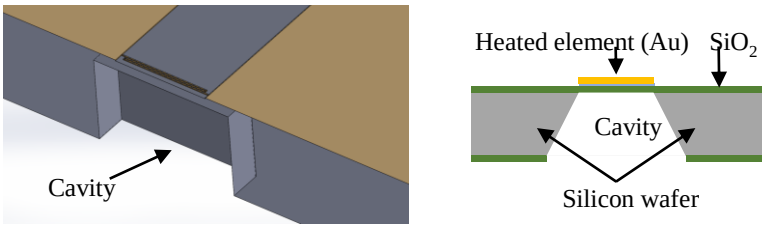
1. *Purpose and Summary*

In this study, simultaneous measurement of the **wall shear stress fluctuation and streamwise velocity fluctuation in a boundary layer of a turbulent wall jet** is performed to investigate the relation between the wall shear stress fluctuation and large scale coherent vortex structures.

2. *Experiments*



(a) Perspective and top view



(b) Cross-sectional view

Fig. 1 Micro-fabricated hot-film (HF) sensor

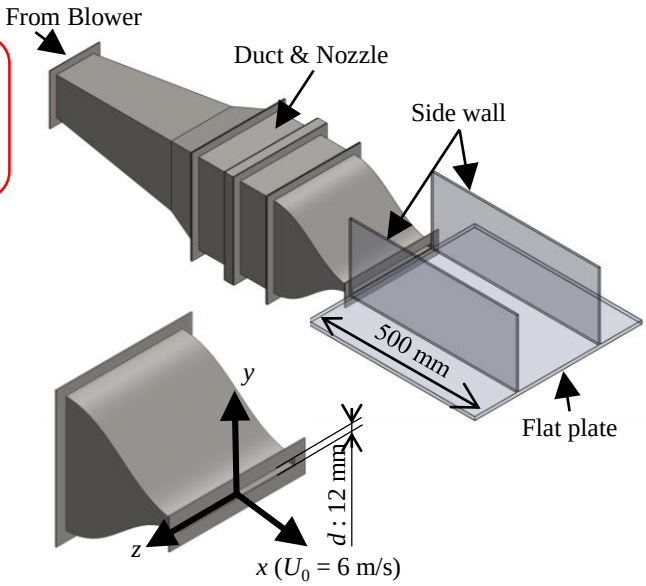


Fig. 2 Experimental setup of turbulent wall jet

3. *Results*

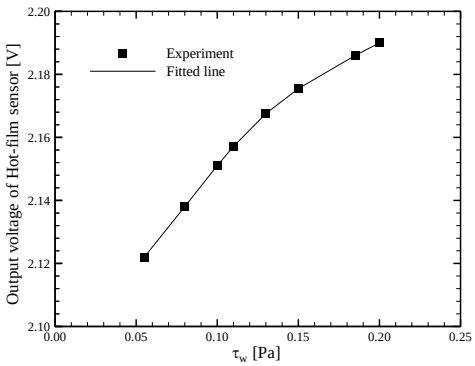


Fig. 3 Static response of HF sensor (x / d = 30)

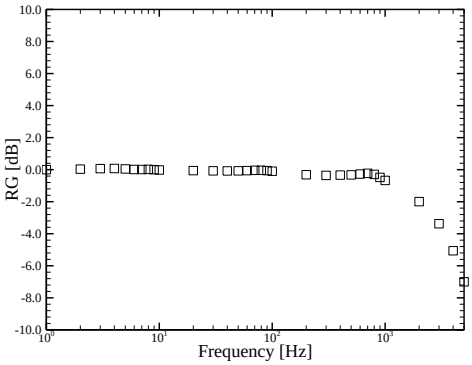


Fig. 4 Dynamic response of HF sensor

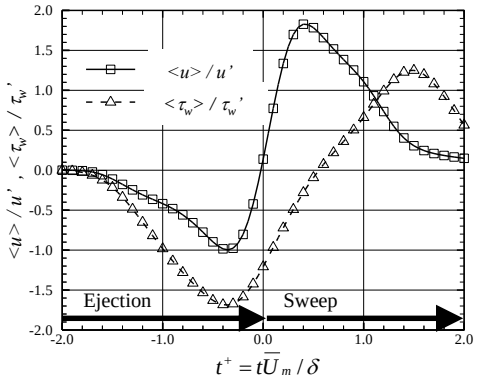


Fig. 5 Ensemble-averaged velocity and wall shear stress in Bursting event (x / d = 30)

4. *Conclusions*

1. Ejection caused rapid decreasing of wall shear stress fluctuation, whereas Sweep caused its gradual increasing.
2. Change of wall shear stress in Ejection was bigger than that of Sweep.

Both Ejection and Sweep had a role to make turbulent energy $-\overline{uv}$ but Ejection had more important influence on the change of wall shear stress and $-\overline{uv}$.

Acknowledgements

This study was partially supported by Toyota Physical & Chemical Research Institute Scholars, JKA and its promotion funds from AUTO RACE, the Suzuki-Foundation, and Grants-in-Aid for Scientific Research (No. 25630051).