Thermal study of Flapping Jet by Infrared Thermography

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Abstract

The paper will describe an experimental investigation of the convective heat transfer in the case of planar air let impinging a hot V-shaped surface. In such a flow configuration the two-dimensional jet experiences a flapping behavior leading to a stable self-sustained periodic flow characterized by a constant Strouhal number as depicted in Figure 1.

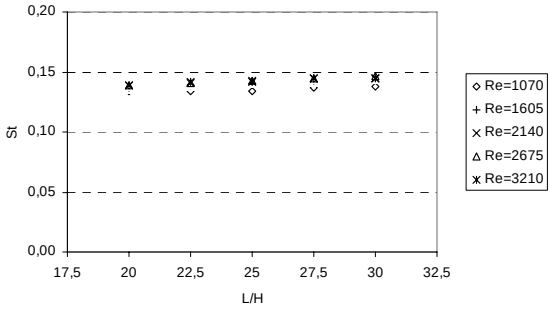

Figure. 1. Flapping-jet Strouhal numbers versus dimensionless standoff distance for different Reynolds numbers.

To determine the time-dependent mapping of the temperature wall, infrared thermography is used in connection with a very thin metallic-foil of low heat capacity for the test surface, which is heated by Joule effect. A view of the setup is proposed in Figure 2.

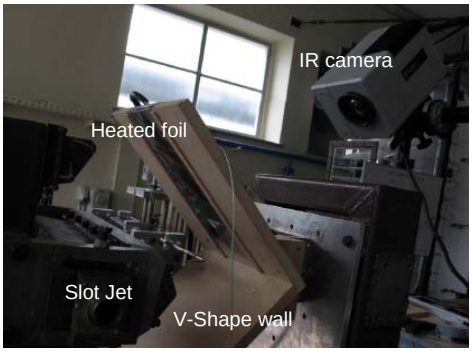

Figure. 2. View of the test setup

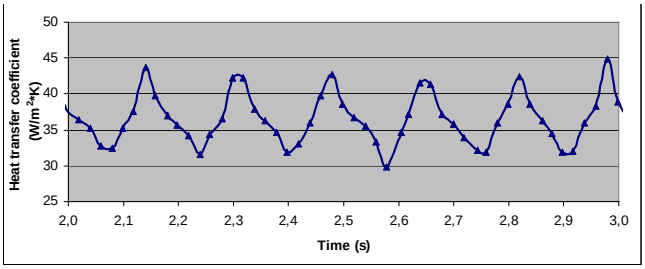

Figure 3: Time variation of local heat transfer coefficient

The effect of the crucial parameters on heat transfer is analyzed. Typical time variation of local wall heat transfer coefficient is plotted in Figure 3: The flapping frequency is well retrieved. Figure 4 shows that the time-averaged dimensionless heat transfer coefficient (Nu number) exhibits a decrease of about 13% as the standoff distances nozzle increases by 50%.

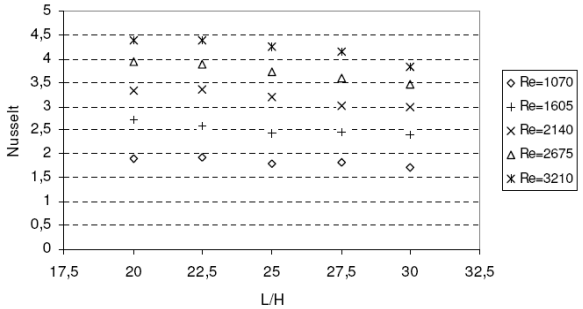

Figure. 4. Heat transfer versus dimensionless standoff distances for different Reynolds numbers.