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Interaction Between Two Synthetic Jets at Various Distances

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Extended Abstract

In addition to steady continuous jets, there are also excited jets, such as synthetic jets. Synthetic jets have the characteristic of repeated jetting and suction, forming a jet by entrainment, even though the net flow rate is zero. Because synthetic jets, which are oscillatory phenomena, have such oscillation parameters as frequency and amplitude, methods for controlling the flow field using dimensionless frequencies have been proposed and have attracted considerable attention in recent years [1]. Many studies have been conducted on the basic flow characteristics of synthetic jets, and the characteristics of the velocity distribution of the jet and its generation limit have been clarified [2]. Recently, research has expanded to the subject of the interference between two synthetic jets. Flow visualization revealed that the flow characteristics depend on the phase difference of the exit velocities and that no jet is formed when the phase difference is π [3]. However, because the results were obtained under conditions in which the exit slot spacing of the two jets was fixed to a constant, relatively small value, much remains unknown regarding the effect of slot spacing on the interference of the jets.

In this study, two synthetic jets were generated, and experiments and numerical simulations were performed under the conditions that the exit velocity variation is phase difference π and the distance c between the slots is a parameter. The influence of the slot-to-slot distance c on the flow characteristics was primarily investigated. Several typical examples of flow fields were examined under the condition that the slot-to-slot distance c = 1–100 mm. In addition to the slot-to-slot distance, the other conditions were $U_{A,0}=U_{B,0}=6.0\,m/s$, slot width $b_A=b_B=5.0\times10^{-3}\,m$, and input frequency $f=¿$ 20 Hz, which were constant for the synthetic jet. In the experiments, the flow was visualized, and the velocity profiles were measured. In the numerical simulations, a tetra mesh with a mesh count of 200,000 was used, and the surface was cut on a circular arc. The standard k–ε model was used as the turbulence model. The main results were that, for a slot-to-slot distance $c=1\,mm$, no substantial jet was formed downstream of the slot, whereas, for $c=100\,mm$, a jet formed clearly. These results indicate that jet formation depends on the slot spacing, as verified by the interference of a synthetic jet with a phase difference of π.

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