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ACTIVE CONTROL USING MOVING BOTTOM WALL APPLIED TO OPEN CAVITY SELF-SUSTAINED OSCILLATION WITH MODE SWITCHING

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Flow past an open cavity is known to give rise to self-sustained coherent oscillations of the shear layer. The primary frequency of the shear layer oscillations varies with the cavity length. Self-oscillatory regimes of shear layer are classified into mode II, mode III and wake mode. The flow features of these mode are significantly different. We investigated these differences by two-dimensional simulations [1].

The control of cavity flow oscillations is one of the challenging topics in flow control problems. We carried out two-dimensional numerical simulations and developed a new method by which the moving bottom wall of the cavity controlled the self-sustained oscillating flow over a cavity [2]. We succeeded to suppress oscillation at the cavity aspect ratio $\Gamma = 2.0$ in mode II. However, the effect of our control method on the flows at different cavity aspect ratios and different oscillatory modes is not obvious.

The major aim of this investigation is to reveal the effect of our new control method to different cavity aspect ratio and different modes. Two-dimensional direct numerical simulations with our control method were performed for the flows at $\Gamma = 2.0$, 2.5, 3.0, 3.5, and 4.0. The mode II appears at $\Gamma = 2.0$, 2.5 and 3.0. The mode III emerges at $\Gamma = 3.5$. At 4.0, the flow is in wake mode. The bottom wall moving velocity is varied from 0.0 to -2.0, where the direction of moving wall is from the downstream to the upstream. The results of controlled simulations show that the self-sustained oscillations are completely suppressed by our control method using bottom wall for all oscillatory modes with moderate bottom wall moving velocities. The oscillations are maintained in the case of too late moving velocities or too fast moving velocities.

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