MEAN FLOW AND FLUCTUATIONS AROUND SHALLOW CAVITY AT HIGH SUBSONIC VELOCITIES

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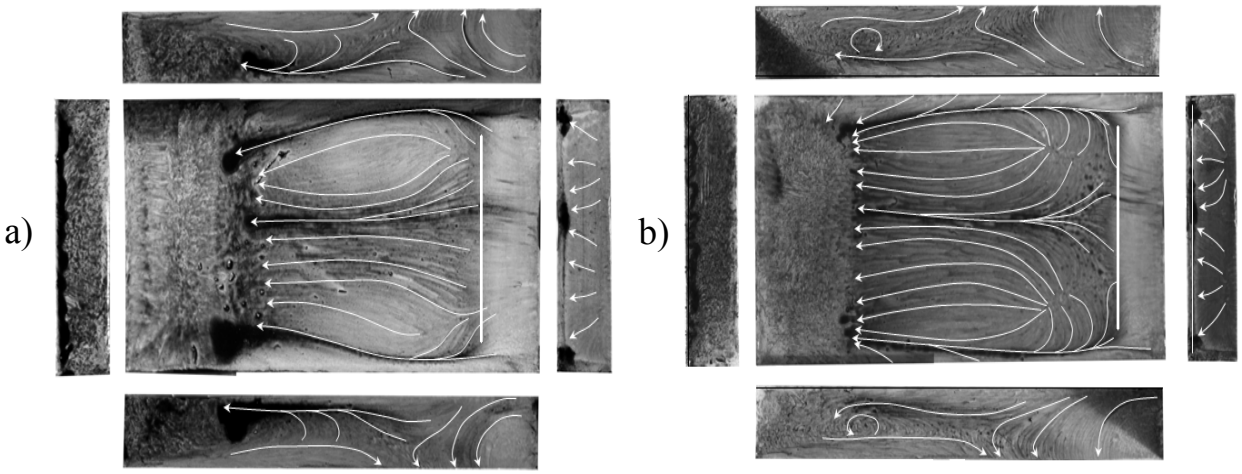
Results of panoramic flow visualization in the open cavity and local measurements of flow characteristics, including the fluctuations with the help of hot-wire technique and surface MEMS sensors, allowed one to obtain quite detailed picture of the three-dimensional flow in the cavity. The features around the cavity in resonance and non-resonance flow regimes are determined, see pictures a) and b) respectively in the figure below.



Oil visualization of flow about the cavity (flow from the left to the right)
a) M = 0.4; b) M = 0.7.

Fourier spectra of signals obtained by the MEMS sensors on the cavity surface and hot-wire located in the free flow above, showed that there are fluctuations outside the cavity corresponding to both the main modes and higher order ones.

It was revealed from the analysis of the results that the high-intensity pressure fluctuations at the Rossiter frequencies occur in the flow almost always. But when the conditions are not satisfied to resonant ones, the intensity of pressure fluctuations came down quickly. The flow switch to a resonant state is due to increase of duration of individual inclusions of the Rossiter modes.

The additional condition of transition to resonant state is as follows: the sum duration of the fluctuations, the amplitude of which exceeds the threshold value, is at least 15% of the total time.

Number of dominant mode can be predicted in some cases by comparing the characteristic sizes of the model and the length of acoustic waves corresponding to the calculated values of the Rossiter modes.

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