VORTICES CHARACTERIZATION IN A CAVITY AT LOW SPEED

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Separation and reattachment of turbulent flows occur in many practical engineering applications both in internal flows such as diffusers, combustors and channels with sudden expansion and external flows like those around airfoils and buildings. Among the flow geometries used the studies of separated flows, the most frequently selected one is the cavity flow. This study also uses a cavity to simulate internal flow of a solid rocket motor due to its geometrical simplicity.

The primary aim of this study to understand and characterized the cavity flow, the vortex-shedding mechanism and wall-vortex interaction through statistical assessment of the compiled data. The aim is also to create a wide and reliable data base for such a complicated flows and to try to answer questions related to the creation of vortices, their dimensions, energy contents and trajectory

This experimental study was carried out by the use of hot wire anemometry and particle image velocimetry (PIV). The mean flow field was obtained by statistical processing a large number of instantaneous flow fields measured by PIV. A wavelet analyses were used to reveal the vortex attributes and locations. The experiments were carried out three different Reynolds number, two different cavity lengths to depth ratios. The effect of the regime of the upstream boundary layer (laminar and turbulent) was also investigated.
The results are given in terms of mean flows (mean flow velocity, turbulence characteristics, Reynolds stress) and also in terms of parameters such as probability density function of presence of vortices, trajectories of vortices, vortex size, vortex circulation and vortex size versus energy.

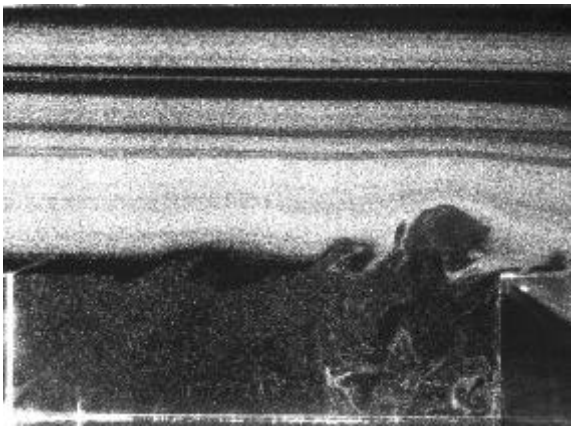

Figure1: Cavity Flow

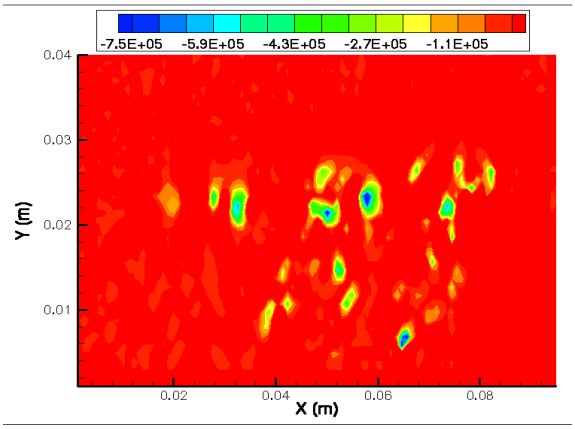

Figure2: Vortex detection with wavelet analyses