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THE INFLUENCE OF STREAMWISE VORTICES ON SHOCKWAVE UNSTEADINESS

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The UFAST (**U**nsteady e**F**fects of shock w**A**ve induced **S**epara**T**ion) project, a part of 6th Framework Programme, was focused on experimental and theoretical work in the area of unsteady shock wave boundary layer interaction.
The IMP PAN was conducting experimental work covering the streamwise vortices flow control method.

After having completed the UFAST programme, further research , focused on shockwave unsteadiness was undertaken by the authors. The influence of streamwise vortices on the unsteadiness of shockwave system at a constant Mach number flow was the main topic. The experimental work was carried out in a nozzle inducing uniform outlet stream, like the one in the measurement stand, depicted in Figure 1.

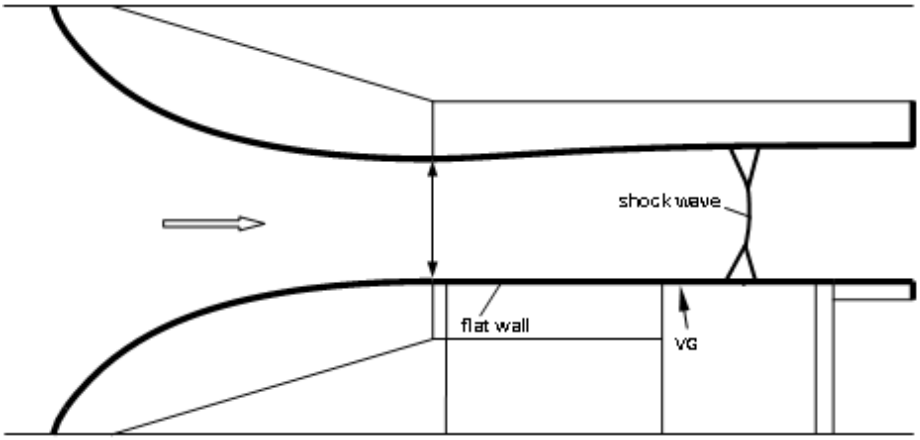

figure 1 Experimental stand

Using a high-speed CCD camera a set of Schlieren visualizations of the shock system was recorded, with the recording frequency of up to 10kHz. Moreover, the oscillations of the static pressure in four positions on the lower wall:

1)upstream of the shock wave,
2)in the shock wave position,
3)in the reattachment zone and
4)downstream of the reattachment line, were measured using fast-response KULITE pressure transducers. The sampling frequency used in the experiment was 20kHz.

The oscillations of the main shockwave , and the λ-foot together with static pressures were analysed and characterized by the means of FFT transformation. The temporal analysis of mutual positions of all the three waves have also been conducted.

The obtained results cover:

- the analysis of the motion of the shock wave system,

- the evolution of the shape of the 'λ foot system' during oscillation,
- the analysis of static pressure oscillations.

Our sample results showing the mean movement of the main wave, back wave and front wave of the λ-foot is depicted in figure 2. In addition, an attempt to correlate the shock movement with pressure oscillations and separation region character has been made.

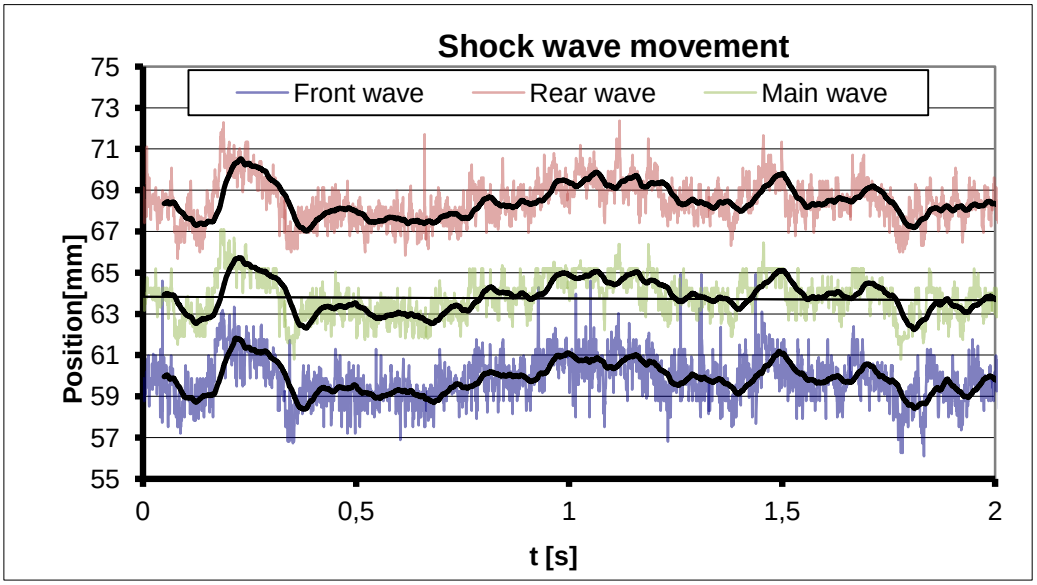

figure 2 Shock wave movement