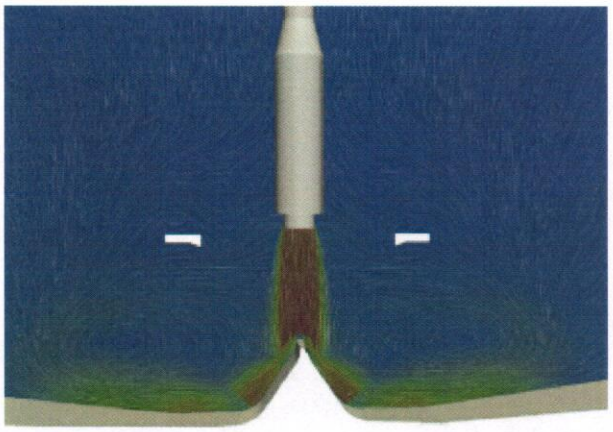

ETC18

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Book of Abstracts

Version 2.0

Keynote Speakes

Acoustic

Mon 4th, 17:00-19:00

Artificial Intelligence I

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Atmospheric Flows I

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Boundary Layers I

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Control of Turbulent Flows I

Mon 4th, 11:30-13:30

Control of Turbulent Flows II

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Experimental analysis of pulsatile flow in a transitional-type cavity

J. Šereika[a], P. Vilkinis[a] and N. Pedišius[a]

The combination of flow separation and pulsatile flow phenomena is common in the biomedicine field of research, where the blood flow in arteries is dominated by the unsteady flow. Furthermore, pulsatile flow investigations in various lab-on-chip devices are also at the top of interest nowadays as it is often applicable in many engineering and biomedical applications. An experimental investigation of pulsatile flow structure is performed in a transitional-type cavity with a length-to-depth ratio of 8 using a micro-particle image velocimetry system. The pulsatile flow is generated by pulsating the inlet pressure in sinusoidal pulses with a pressure control unit. Stationary flow and four sets of pulsatile parameters were investigated: two pulsation amplitudes (A = 0.15 and A = 0.6) and two pulsation frequencies (f = 0.5 Hz and f = 1 Hz) at the Re range of 50–2000. Recirculation flow dynamics in a cavity were analyzed, taking a deeper look into the influence of pulsations on the flow structure and statistical flow parameters such as vorticity, shear rate, and turbulence intensity. Analysis revealed that the influence of pulsation amplitude on recirculation zone dynamics has a more prominent role than pulsation frequency. The magnitude of the recirculation zone reduction effect, achieved by pulsatile flow, is inversely proportionate to pulsation amplitude. The reduction of the recirculation zone impacts the shear rate distribution along the cavity by decreasing it when the recirculation zone length is reduced. Additionally, the analysis of turbulence intensity revealed the negligible impact of pulsations when the flow approaches the turbulent flow regime.

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Investigation of flow over triangular roughness elements in a cavity

P. Vilkinis[a], J.Šereika[a], N. Pedišius[a]

Studies of flows over various roughness elements and ramps or riblets on the channel wall are concerned with flow resistance reduction, heat transfer intensification and the solution of other challenges related to knowledge and control of fluid dynamics. In this work, pressure losses and flow dynamics are studied experimentally in a cavity formed by two ramps on the channel wall and filled with triangular riblets. The length and amount of riblets are changed from one large to three smaller, occupying the entire cavity length and dividing it into smaller subcavities between riblets. Up to four subcavities, characterised by length-to-depth ratio λ = 8.8–2.8, are formed. Pressure loss regularities and flow structure above such cavity are investigated in a wide range of Re numbers (430–18000) covering laminar, transitional, and turbulent flow regimes. The pressure loss regularities were found depending on the ramps forming the initial plane cavity, while the riblets contribution is minor. However, their influence on the distribution of flow velocity and turbulence parameters is significant. Decreasing subcavities size between riblets, pressure losses increase until the critical size of subcavities is reached. Further reducing subcavities size, the interaction of the main flow and flow in subcavities diminishes, leading to decreased pressure losses. Measured velocity and shear rate profiles reveal dynamics of instabilities above vertices of riblets and their dependence on flow regime and subcavities size.

Our findings are anticipated to serve as a roadmap for passive flow control using riblets in the limited length chambers. Presented results provide a quantitative framework for selecting riblets configurations for developing applications where flow control and pressure losses play a major role.

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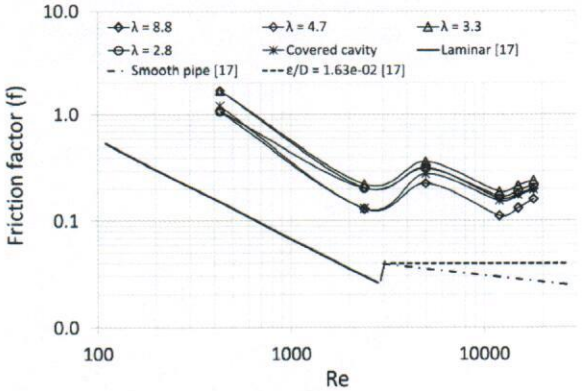

Figure 1. Friction factor dependence on Re for different riblets configurations