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Visualization of a Narrow-band Transient Liquid Crystal Signal on a Film-cooled Contoured Platform of a Nozzle Guide Vane for Film Cooling Performances Measurements

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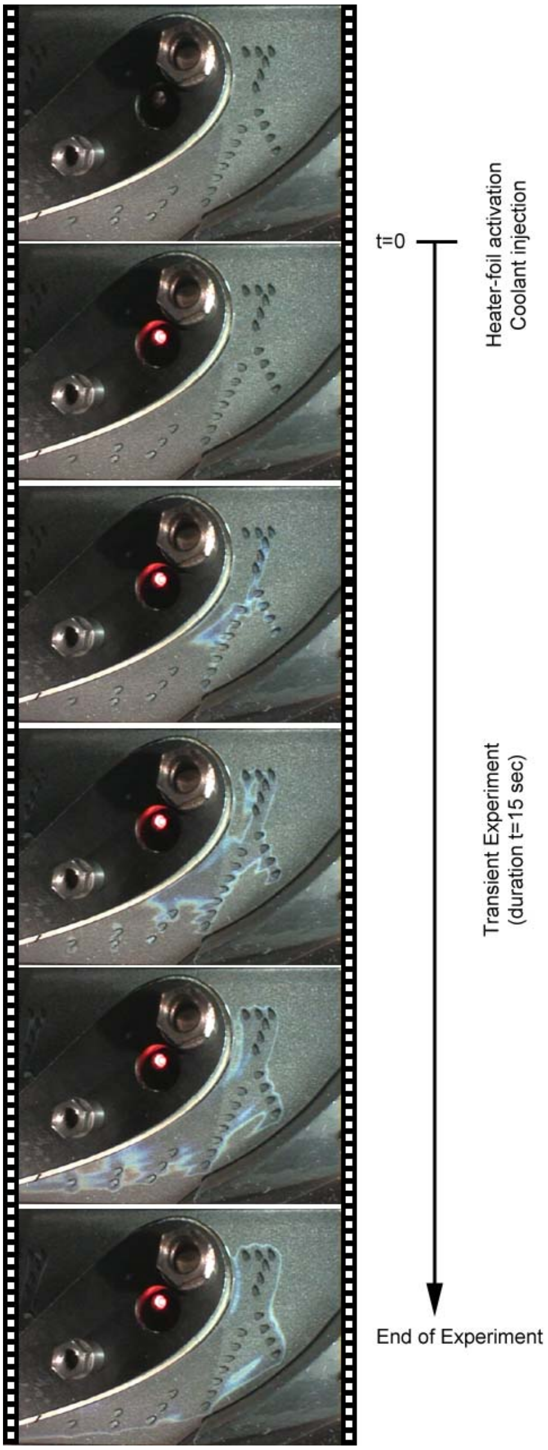

This figure shows a series of pictures issued from a transient liquid crystal experiment applied on a film-cooled contoured nozzle guide vane platform. The transient experiments were performed using an electrical heater foil applied on the surface and heated at different temperature levels. The air coolant gas was simultaneously injected at different temperature levels resulting in different time event detection of the narrow-band liquid crystal color on the surface. The following paint layers were used for these experiments:

Black backing acrylic layer: Hallcrest BB-G1
Liquid crystal layer: Hallcrest BM/R36C07W
Varnish protection layer: Hallcrest binder AQB-2

The evolution of the color information on the surface is then reduced in order to obtain the film cooling performances.

Transient liquid crystal sequence on a film-cooled surface with air injection

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Visualisation of the Two-Phase Gasoline/Air Flow Around Engine Intake Valves using Back-Lit Photography Techniques

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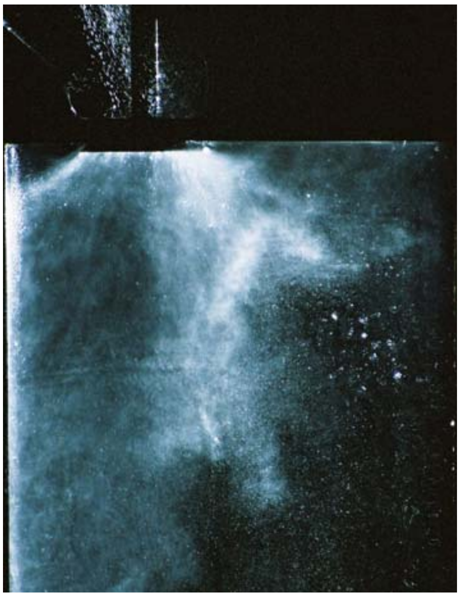
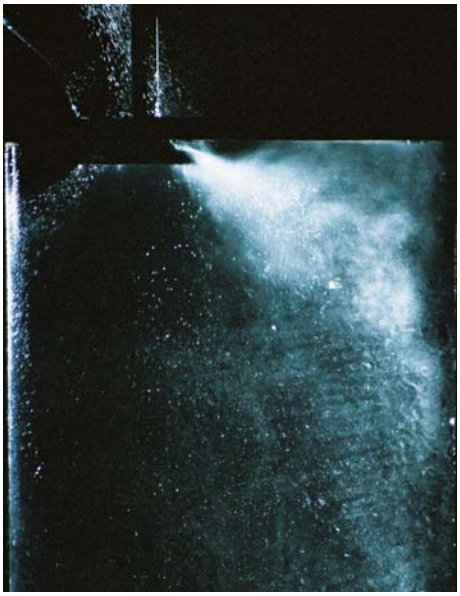


a) L = 1.75 mm

b) L = 3.25 mm



c) L = 4.75 mm

d) L = 6.23 mm

Figures a) - d) show the two-phase flow around an engine intake valve. Injection commences at the camshaft angle of 20° after the valve begins to open and the engine speed is 400rpm. The two-phase flow is drawn through the experimental apparatus by a vacuum pump. The atomisation of the gasoline is more pronounced at low valve lifts due to the faster flow of air through the valve gap. With an increase in valve lift, the flow through the valve gap decreases in magnitude resulting in a reduced amount of gasoline being atomised.

Bio -Tissue Structure Monitoring under Shock Wave Treatment

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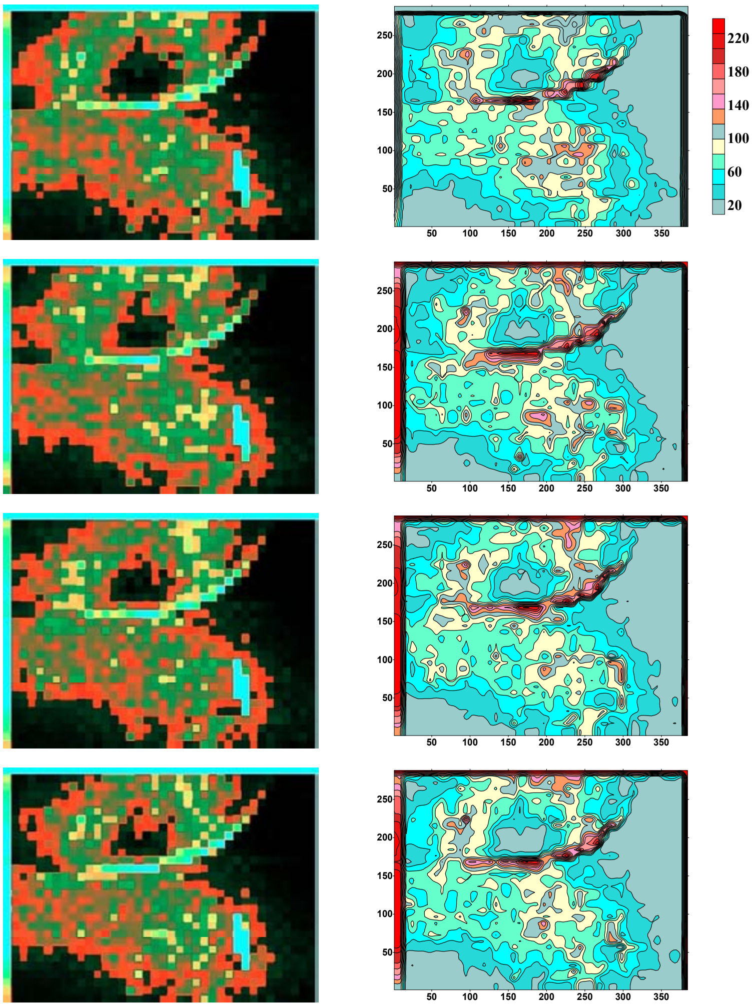

Real-time maps showing the intensity of the subskin blood flux reconstructed by the contrast variation in single-exposure (prolonged-exposure) speckle photography (left) and isolines of these maps (right)

The dynamic bio-speckle patterns were generated by illumination of living tissue via laser light and were recorded using a standard digital CCD camera (768 x 494 pixels) at a frame rate of 25 frames/second. The exposure time varied from 10 μs (for cross-correlation analysis of subsequent frames) to 1/60 s (for a single exposure mode). Speckle patterns were recorded as a distribution of gray values I(m,n) in digital form for each pixel (m,n) of the CCD matrix. In real-time operation the image analysis is performed during the time interval between subsequent (two or more) frames.

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Mean and Turbulent Flow Field in the Wake of a Ship Model by LDV

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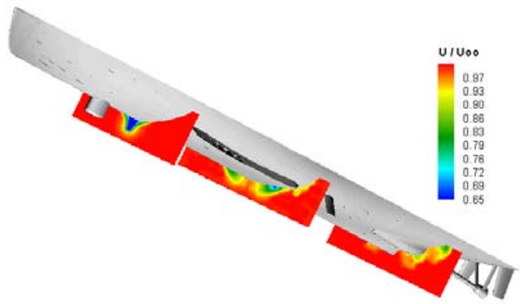
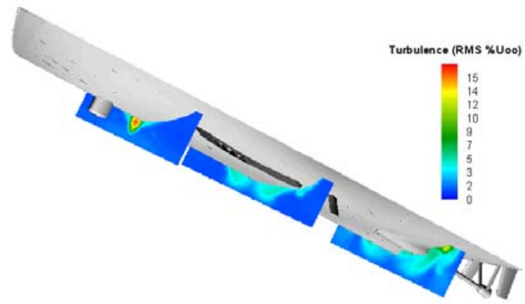
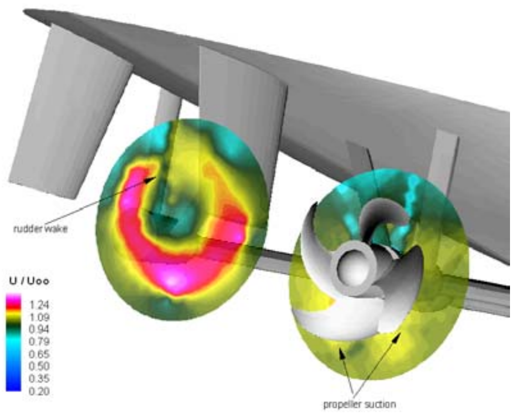


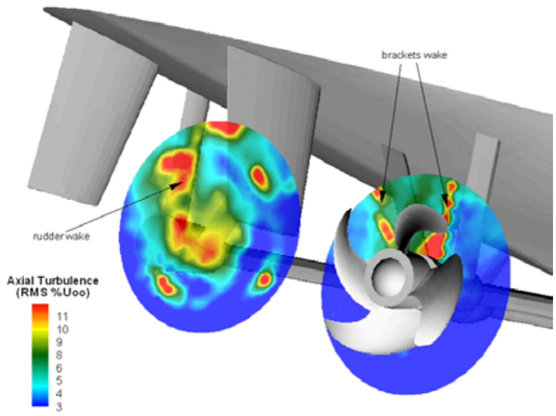
Axial velocity evolution
(bow and midship frames)



Axial turbulence evolution
(bow and midship frames)



Axial velocity evolution (stern frames)



Axial turbulence evolution (stern frames)

The above figures show some of the results of a wake survey performed along a ship model in a large tow tank. Wake analysis was carried out along five transversal sections of the hull using an LDV system. Measurements included a standard analysis of the average and turbulent velocity field and phase analysis with the propeller angular position (which was limited to the stern sections). The analysis emphasizes some significant features of the ship wake, such as bulbous bow and the ship appendage vortices evolution. The adoption of phase sampling techniques indicated a complex interaction between the propeller and the hull wake downstream from the rudder and the shaft brackets.

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Numerical Analysis of Rotor Blades with and without Film Cooling Holes

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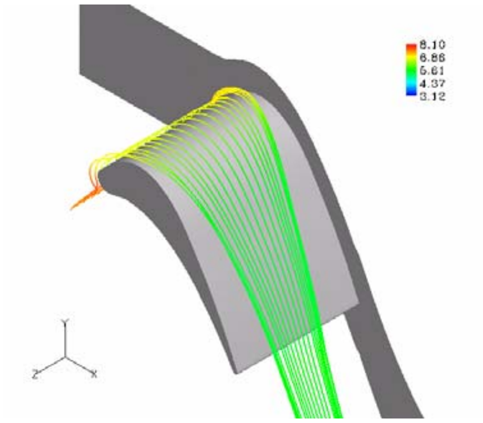
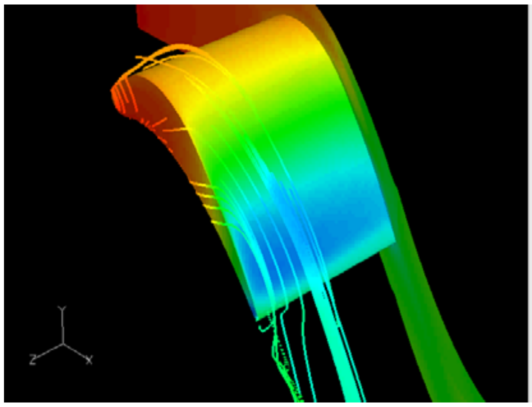
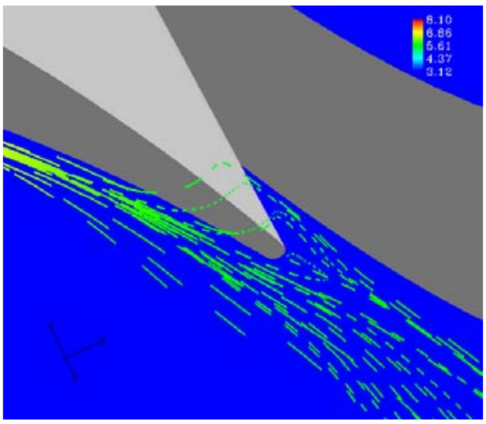


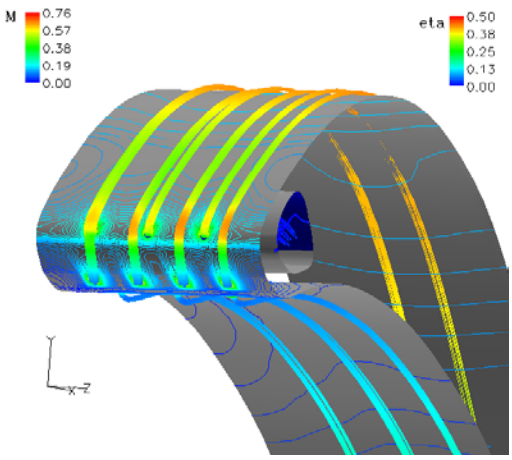
(a)



(b)



(c)



(d)

Figures (a), (b) and (c) show the streamlines of a rotor blade without film cooling holes. Flow conditions are defined as: M_∞=0.3, P_∞=3.294E+5 (Pa), Re=12252, inlet angle of mainstream to blade: 75°. Figure (a) shows the effects of corner vortex and tip vortex. Figure (b) shows the tip vortex system, the blade surface is colored according to pressure, blue representing the low pressure and red representing high. The close-up view of the tip vortex is shown in Fig. (c). Figure (d) shows the flow around the blade with film cooling holes. Coolant is supplied from the internal chamber (the blue area). The contours on blade surface are colored according to adiabatic film cooling effectiveness. The streamlines, seeding on the coolant supply chamber, are colored according to Mach number.

Visualization of Shock Wave Diffraction on 3D Edge

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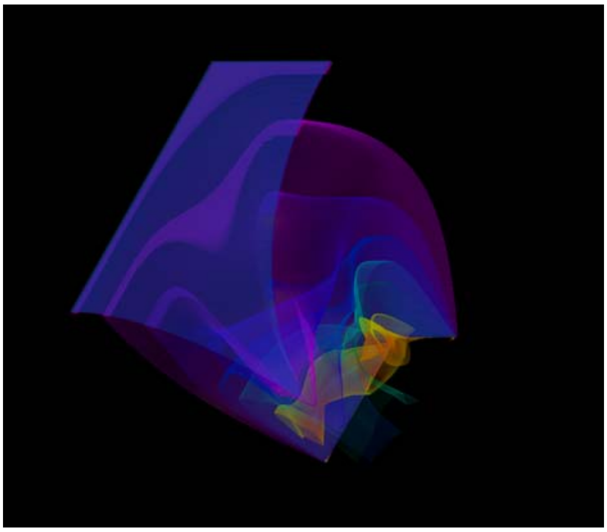
1) GDT Software Group, Tula, Russia, E-mail: info@cfd.ru, URL: www.cfd.ru



Pressure iso-surfaces, colored according to density

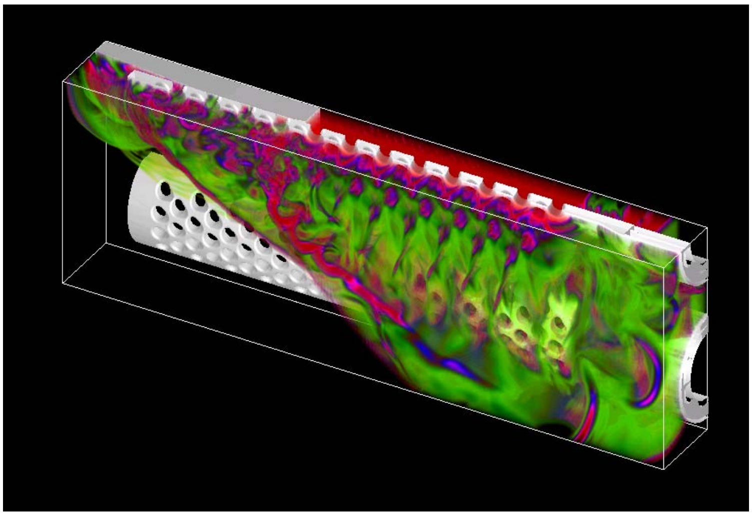
From the rear, the solid edge has been removed to improve the transparent view

Strong shock wave diffraction on a three-dimensional sharp edge was simulated using the GasDynamicsTool CFD package. Wave velocity was 2400 m/s, and the calculation domain consisted of 45 million cells. Computation was done using a dual-processor PC (Athlon 1800+ 1.5 Gb RAM). A very complicated flow pattern arises after diffraction in the vicinity of edge tip. In order to visualize this flow, semitransparent voxel technology in iso-surface realization was used.

Twin Barrel Artillery System Function

Zibarov, A. V. [1], *Babayev, D. B.* [1], *Mironov, A. A.* [1], *Komarov, I. J.* [1], *Konstantinov, P. V.* [1], *Medvedev, A. V.* [1] *and Karpov, A. N.* [1]

1) GDT Software Group, Tula, Russia, E-mail: info@cfd.ru, URL: www.cfd.ru



First derivative of pressure distribution

It illustrates the operation of a twin barrel artillery system. Each barrel has muzzle break consisting of holes that is designed to reduce the recoil. The simulation was performed using the GasDynamicsTool (GDT) CFD code, and the ScientificVR package provided the visualization. At the moment of image capture, a projectile is leaving the muzzle of the upper barrel. Formation of the blast wave in front of the projectile and the lateral shock wave from outgoing gases from the gas vent holes are visualized well. The first-derivative of pressure is presented using the semitransparent voxel technique.