

Device capable of producing mist

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The Novosibirsk researchers have developed a device capable of producing mist with support from the Russian Foundation for Basic Research and the Foundation for Assistance to Small Innovative Enterprises (FASIE). The precise name of the device is “field device for measuring liquid and gas velocities”. It helps to perform prompt, precise and, most importantly, simultaneous measuring of the velocity at any point of the fluid and gas flow.

“Field device for measuring liquid and gas velocity” is the name of the device developed and produced by the researchers of Institute of Thermal Physics, Siberian Branch, Russian Academy of Sciences (Novosibirsk) with support from the Russian Foundation for Basic Research and the Foundation for Assistance to Small Innovative Enterprises (FASIE). The device helps to track in full detail the life of the flow and to learn, for example, what the velocity is at each point, how and where turbulences appear. In other words, it is possible not only to “shoot an animated film” about the flow of liquid or gas, but also to perform mathematical treatment of each “shot”.

The device operations are based on the principle known since the times of Prandtl and other classical hydrodynamics scholars. This is the so-called stroboscopical visualization of flows. In other words, small particles – tracers – are placed in the flow transparent for employed irradiation. The tracers do not influence the stream, they drift together with the flow, but the tracers are not transparent for irradiation.

If the flow containing such tracers is illuminated by short flashes of light

with a certain delay between the flashes and if every time the flow is shot on cinefilm, photographic film or camera-recorder, then there will be a sequence of “snap shots” of the particles. Analyzing them, it is possible to determine velocity of liquid or gas in the flow or, in specialists’ terms, to visualize field of flow velocities.

There are a lot complications here. It is necessary that everything – tracer-particles generator, radiation source (usually, this is laser) and digital camera-recorder – worked exclusively synchronously under control of a computer. However, processing of the acquired images is more complicated. It is extremely complicated and laborious when done manually (that is the way it was done previously), particularly in turbulent flows, where statistical analysis of a large quantity of instantaneous field of velocities is required. For computer to do this, appropriate software is required – algorithms with the help of which electronic brain quickly and accurately extract information about velocity of each particle from distribution of particles in time and space, and consequently, about velocities of flow at each point.

These algorithms in particular make the major share of all know-how in this method. The Novosibirsk researchers have coped with the development of algorithms, as well as with the first technical task. It should be noted that the algorithms developed by the researchers are a part of the ten world leaders in this area.

The first device is already in place. Especially for the device, the researchers have developed the mist spray generator, synchronizer processor that allows to control NdYAG pulsed lasers of any model and digital cameras.

“So far, we do not produce yet the field device for measuring liquid and gas velocity of the Institute of Thermal Physics (Siberian Branch, Russian Academy of Sciences), says Dmitry Markovich, Deputy

Director of the Institute of Thermal Physics. Having created the prototype within the framework of innovation program of the Russian Foundation for Basic Research - Foundation for Assistance to Small Innovative Enterprises (FASIE), we are now making single sets of the system upon individual orders. Thus, with support from the Ministry of Science, we are preparing the device shipment to the Institute of Mechanics of Continua (Ural Branch, Russian Academy of Sciences), a request form The Institute of Computational Technologies, Russian Academy of Sciences (Moscow), is under consideration now. There are a lot of consumers of these facilities in Russia, the list of requests has already exceeded a dozen. However, it should be understood that these facilities will never be for the masses. This is a specialized device intended for research laboratories and engineering departments of big corporations. That is the way all over the world. Nevertheless, in Russia this niche is vacant. We hope that it will be filled with a little help from our Institute. And we shall be able to successfully compete in the world market.”

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