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15–16 December 1983, Durham, UK

Applications of LDA counter systems

The LDA Counter Users Group's first two-day meeting, held at Durham University, was a Colloquium at which the participants reported on work recently completed or currently in progress. There were three sessions, reflecting the composition of a Laser Doppler Anemometer system; the first session was concerned with the optics of the LDA system from laser head via the transmission and receiving optics to the photodetector; the second with the collection of data from the photodetector, to the processor via the counter; while the third session was concerned with processing of acquired data, typically in a microcomputer, and with the presentation of reduced data as results. There were also visits to the Laboratories of the Department of Engineering at Durham University to view LDA counter applications and commercial demonstrations of new laser and LDA products were given.

The Colloquium was called to discuss applications of LDA counter techniques and, while these were in the majority, two papers were given on frequency tracker applications and two on photon correlation, one of which described the new burst correlation technique. This broadening of the base gave a wider field against which to view the counter technique. Applications reported ranged from studies of fundamental flows, such as boundary layers, to engineering flows in power station components. The fundamental flows under study included laminar/turbulent transition, obstructions in boundary layers, shear layers, bluff disc wakes, jet mixing and diffusion

flame shear layers, three-dimensional wakes behind cylinder struts, swirling flows, and wet steam flows. The engineering flows included electrostatic dust precipitators and boiler tube banks for power stations and blade passage flows in the rotor row of a mixed flow pump. The fundamental flows under consideration, however, were all abstractions from specific engineering applications so all the papers were of direct significance to real problems.

Although the Colloquium was ostensibly concerned with the application of LDA systems, particularly counters, to real flow problems, there was a significant element of system and technique development in the papers presented even though most of the systems used were commercially supplied. Most LDA applications are, properly, in flows where the sensitivity of the flow to physical interference, the complex nature of the flow, or the sheer hostility of the environment preclude the use of conventional intrusive probe methods. It is not surprising that LDA practitioners need to adapt their systems for specific applications. Developments reported in the Colloquium included a computer program to calculate and plot Gaussian and geometric beam paths through optical systems optimised for measurement volume geometry; the prediction of minimum laser power requirements for measurements in turbid media such as wet steam, using the minimum signal and signal to noise criteria of the processing electronics and Mie scattering theory; the collection and processing of data from time varying flow fields such as swirling flows and turbomachinery flows, including discussion of windowing methods using hardware and software and the subsequent processing of the data by mini and microcomputers.

Several contributors addressed the problems of biassing in the counter output data. This problem affects not only LDA counter techniques but also the newly developed burst correlation technique and there was some discussion of methods for the correction and elimination of arrival rate bias by control of the sampling process and other forms of biassing due to instrument settings of threshold levels, filters, etc. One approach to investigating the effects of bias was taken in a paper which reported a computer simulation of the complete LDA system, modelling the light scattering properties of the seeding particles, light collection by the optics and photodetector and the operation of the counter itself. This simulator would be used to model the effects on bias of changes in the system without expensive rebuilding.

The general mood of the meeting was one of confidence in the ability of the LDA counter technique to produce data of use to engineers working with difficult flow systems, with some reservations about the effects of more esoteric flow phenomena on the quality of the data. The LDA counter technique has undergone considerable development in the last decade and, although there is still more to be done in its development for use in more esoteric flow problems, the participants in this Colloquium gave evidence of considerable enthusiasm for and commitment to a technique which is making a very worthwhile contribution to our knowledge of real flow systems.

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It is hoped that selected papers from this Colloquium will be presented in this journal at a later date. Interested readers may obtain copies of the Colloquium Proceedings, price £10.00, from C. F. King, Department of Engineering, University of Durham, Science Laboratories, South Road, Durham DH1 3LE, UK or from J. T. Turner, Simon Engineering Laboratories, University of Manchester, Manchester M13 9PL, UK.

BOOK REVIEW

Proceedings of the Seventh Conference on Fluid Machinery

Eds. L. Kisbocskói and Á. Szabó

At the seventh International Conference on Fluid Machinery in Budapest in September 1983, a total of 108 papers were presented by scientists and engineers from 22 countries. They are now available in two volumes with 969 pages.

In this brief review it is impossible to list, let alone comment on, the numerous subjects covered. Suffice it to say that the majority of papers will be of direct interest to designers and chief engineers concerned with pumps and pumping systems. A number of papers were devoted to compressor problems and some dealt likewise with turbines and their components. Newer applications of turbines, such as harnessing wind power were also discussed.

Some papers describe fundamental research into topical turbomachinery flow problems such as flow in profile cascades, in diffusers, curved channels, and so on. Attention was also paid to numerical methods of flow solution in parts of blade-type engines, beginning with the non-compressible flow and ending by the transonic flow, as well as to problems of interaction between the potential flow and the boundary layers. Also, experiments in connection with the calculation of flow at an extensive flow separation were reported. A significant proportion of the papers dealt with the cavity and erosion damage, and some papers have been orientated to the measuring technique.

The coverage roughly falls into two main fields; ideal and real flow in fluid machines and related systems; and problems associated with the design, manufacture and operation of turbo-machines. In all cases the papers represent state-of-the art knowledge.

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