

Mach numbers, velocity ratio, coolant and wall temperature ratios, coolant species, free-stream turbulence and pressure gradient.

Macken and Hartnett analyze radiation-convection interaction in a low speed constant property, unity Prandtl number, laminar boundary layer; both gas and wall are gray, and emission and absorption are diffuse. In the optically thin limit, as well as for the general case, heat transfer for axisymmetric and planar stagnation points is compared to that for a flat plate; the results allow inferences to be made for intermediate wedge flows. Durst and Whitelaw review existing methods of measuring mean and fluctuating aerodynamic properties of separated gas flows. The relative advantages of the laser Doppler anemometer are listed and a new optical geometry for Doppler shift measurements is proposed.

Leidenfrost concludes the volume with a very lengthy paper describing in detail the theory, design and use of a multipurpose instrument for determining many properties including, for fluids: thermal conductivity, dielectric constant, a.c. and d.c. electrical conductivity; for gases and vapors: p - V - T properties; for liquids: thermal expansion coefficient, compressibility, vapor pressure, specific heats; for solids: specific heat. Also described is the use of the instrument for an unsteady temperature-free measurement of heat transfer and thermal transport properties.

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J. M. BEER and N. A. CHIGIER, **Combustion Aerodynamics**. Applied Science (1972). £7.00, 264 pp.

COMBUSTION research has developed rapidly during the last two decades and this progress is largely based on the application of aerodynamic principles. The combination of these two fields of sciences is presented here for the first time in the form of a book. It can be seen that it has developed to an independent discipline beside the older branches of combustion chemistry and heat exchange in reacting systems. The two authors have contributed to the work they report upon, partly at Sheffield University and partly at the International Flame Research Foundation in Ijmuiden.

Diffusion flames are normally used in practice. Their shape and properties depend on the exchange of momentum and mass. One of the main aims of fuel technology is to describe these flames, their shape, temperature fields and heat flows by means of the equations of motion. The authors show the degree to which the flame streams can be calculated despite the difficulties which arise from the existence of sources and density gradients. The reader sees the extent to which he must rely upon empiricism.

The central chapters of the book consider free jet-flames of gas with and without swirl; oil flames are also considered. Under the item "stabilisation" the premixed flames which

are necessary for this process are described briefly. Additional extensive sections concern modelling and measuring systems developed specially for flames.

The book provides ready access to its topic. It collects not only the most important results of the authors and other scientists, working in similar ways, but provides additionally a very clear review of the whole field of flow and combustion.

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Fluid Dynamics Measurements in the Industrial and Medical Environment. Edited by DAVID J. COCKRELL. Leicester University Press, 1972. £5.0, 343 pp.

THE BOOK under review contains the papers from a conference held in April 1972 at the University of Leicester. There are forty-five individual contributions, including two invited lectures, one by G. Sovran on Fluid Dynamic Measurements in the Industrial Environment and the other by D. Schultz on Fluid Dynamic Measurements in the Medical Environment. Eight papers deal with biological flows. The majority of the remaining contributions are concerned with various aspects of hot wire anemometry although a significant number deal with laser-Doppler systems as well as reports on such subjects as pressure measurement and void fraction measurement into phase flow.

A key goal of the conference was to point out some of the myriad applications and difficulties of fluid mechanics measurements in industry. The success of this cannot be fully interpreted from the small participation of authors from industry—apparently only two of the forty-five contributions were initiated in industrial laboratories; well over half come from academic institutions and the remainder are from government research laboratories. Perhaps the promised succeeding volume containing the discussion from the conference will provide more industrial response. Sovran in his invited paper certainly does provide much insight into the complications and difficulties of measurements in industry.

It appears, however, that the gulf between the academic researcher and the engineer making industrial measurements or designing industrial instrumentation is not an easy one to cross. This is evident not only in fluid mechanics research but in a number of areas of engineering science, as well as in graduate education whose recipients in the future will be less and less entering areas of academic and pure engineering science research. The attempt by the organizers of the conference and the editor to bridge this gap is commendable. If they do not completely succeed, they are certainly in good company and the resulting volume does provide considerable information on measurement techniques which can prove useful to a number of researchers in fluid mechanics.

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