

are likely to be similar, but the thinning of the jet due to the radial outflow will alter the quantitative values. Further work could also be done on methods used to delay breakaway, such as steps on the Coanda surface at the nozzle exit. These studies should enable improvements in Coanda flare design and the application of curved jets to other situations.

Acknowledgement

The authors gratefully acknowledge the support of British Petroleum plc and the SERC for this work.

References

- 1 Willie, R. and Fernholz, H. Report of the first European Mechanics Colloquium on the Coanda effect. *J. Fluid Mech.*, 1965, **23**, 801
- 2 Bradshaw, P. Effects of streamline curvature on turbulent flows, AGARDograph 169, 1973
- 3 Wilkins, J., Withridge, R. E., Desty, D. H., Mason, J. T. M. and Newby, N. The design and development and performance of Indair and Mardair flares. Offshore Technology Conference, 1977, Houston, Paper No 2822
- 4 Carpenter, P. W. and Green, P. N. Noise sources in external Coanda-type gas flares. 8th Aeroacoustics Conference, Atlanta, 1983, Paper No AIAA-83-0758
- 5 Morrison, J. F. and Gregory-Smith, D. G. Calculation of an axisymmetric turbulent wall jet over a surface of convex curvature. *Int. J. Heat and Fluid Flow*, 1984, **5**(3), 139–148
- 6 Morrison, J. F. A study of the axisymmetric wall jet with streamline curvature and its application to the Coanda flare, PhD Thesis, Durham University, 1982
- 7 Love, E. S., Grigsby, C. E., Lee, L. P. and Woodling, M. J. Experimental and theoretical studies of axisymmetric free jets, NASA Tech. Rep. R-6, 1959
- 8 Benson, R. S. and Poole, D. E. Compressible flow through a two-dimensional slit. *Int. J. Mech. Sci.*, 1965, **7**, 315
- 9 Newman, B. G. The deflection of plane jets by adjacent boundaries—Coanda effect. In *Boundary Layer Theory and Flow Control*, ed. Zachmann, G. V., Pergamon Press, 1961, 232
- 10 Wilson, D. J. and Goldstein, R. J. Turbulent wall jets with cylindrical streamwise surface curvature. *ASME J. Fluids Eng.*, 1976, **98**, 550
- 11 Launder, B. E. and Rodi, W. The turbulent wall jet—measurement and modelling. *Ann. Rev. Fluid Mech.*, 1983, **15**, 429
- 12 Bakke, P. An experimental investigation of a wall jet. *J. Fluid Mech.*, 1957, **2**, 467
- 13 Sharma, R. N. Experimental investigation of conical wall jets. *AIAA*, 1981, **19**, 28
- 14 Roderick, W. E. B. Use of the Coanda effect for the deflection of jet sheets over smoothly curved surfaces, Pt II—some tests with supersonic over and under expanded jet sheets. *U.T.I.A.*, 1961, T.N. No. 51
- 15 Korbacher, G. K. The Coanda effect at deflection surfaces detached from the jet nozzle. *Can. Aero. Sp. J.*, 1962, **8**, 1
- 16 Bradbury, L. J. S. and Wood, M. N. An exploratory investigation into the deflection of thick jets by the Coanda effect, RAE, 1965, Tech. Rep. 65235
- 17 Gregory-Smith, D. G. and Robinson, C. T. The discharge from a thin slot over a surface of convex curvature. *Int. J. Mech. Sci.*, 1982, **24**, 329
- 18 Gilchrist, A. R. The development and breakaway of a compressible air jet with streamline curvature and its application to the Coanda Flare, PhD Thesis, Durham University, 1985
- 19 Benson, R. S. and Poole, D. E. The compressible flow discharge coefficients for a two-dimensional slit. *Int. J. Mech. Sci.*, 1965, **7**, 337
- 20 Alder, G. M. The numerical solution of choked and supercritical ideal gas flow through orifices and convergent conical nozzles. *J. Mech. Eng. Sci.*, 1979, **21**, 197
- 21 Guitton, D. E. and Newman, G. B. Self-preserving turbulent wall jets over convex surfaces. *J. Fluid Mech.*, 1977, **81**, 155
- 22 Gilchrist, A. R. and Gregory-Smith, D. G. The compressible Coanda Wall Jet—predictions of jet structure and comparison with experiments. (to be published)

Book reviews

Technical Guide to Thermal Processes

J. Gosse

At the price of £7.95 the book, the work of a French professor of energy engineering, is good value. This compact volume of some 220 pages is, according to the publishers, intended as a course text for engineering students and a reference for professional engineers.

The subject area covered by book is described as thermal physics which basically consists of principles of thermodynamics, fundamental ideas and experimental data on the properties of fluids, heat transfer by conduction, convection and radiation and mass transfer. Because of the limited space available for the wide range of topics covered in the book, the treatment of the subject matter has necessarily to be concise. However, the concepts and principles of thermodynamic analysis, particularly different aspects of the Second Law, irreversibility and exergy analysis are not amenable to such a concise treatment and hence in this particular area the book is less than successful. Consequently, it cannot be recommended as a course text for engineering students. The book is much more successful where principles and laws of thermodynamics and heat transfer are expressible in a mathematical form. The equations relating to the different modes of heat transfer and

mass transfer are numerous and up to date. These equations as well as those expressing laws of conservation of mass, energy and momentum have been stated in concise mathematical forms using, where applicable, vector and tensor notation. The book contains many useful tables and charts with thermo-chemical data, properties of substances and mathematical constraints. The general tenor of the book is academic rather than practical and therefore it will suit better research engineers and research students rather than practising professional engineers.

T. J. Kotas
Department of Mechanical Engineering,
Queen Mary College,
London, UK

Published price £22.50, by Cambridge University Press, The Edinburgh Building, Shaftesbury Road, Cambridge CB2 2RU, UK, 227 pp.