TABLE OF CONTENTS PREFACE

1 1. Test Cases .2

1.1 General introduction to the test cases 2

1.2 Introduction of exDerimental results for test case calculations 3

M. Sommerfeld, H.-H. Qiu 4 Experimental studies on sprayevaporation in a turbulent flow

R.J. Perkins 18

The entrainment of heavy panicles into a plane turbulent jet

M. Maeda, T. Ishima. K. Hishida 34 Panicle dispersion in turbulent mixing layer: Effect of panicle residence time in eddy motion of gas phase

H. Fogt and M. Peric 42 Numerical study of the wake behind a splitter plate and its effect on mixing layer

1.3 Introduction of numerical methods applied 52

A. Berlemont. M.S. Grancher and G. Gouesbet 53 Langrangian Simulation of heat and mass transfer in dispersed two- phase flows

V. Christoforou. P. Prinos and A. Goulas 55 Numerical model and method for test case 3

G. Koopmans and B. P. Markarov 57 Panicles falling through a plane horizontal jet

J.C.F. Pereira, X.Q. Chen and J.L. T. Azevedo 59 Numerical prediction of evaporating sprays

0. Simonin and I. Flour 61 An Eulerian approach for turbulent two-phase flows loaded with discrete panicles

P.J. Spies. G. Kohnen and M. Sommerfeld 63 Numerical models for the prediction of sprayevaporation in a turbulent flow

M. Sommerfeld 65 Numerical method and model for calculating panicle dispersion in a turbulent flow

2. Results of Test Case Calculations 68

- 2.1 Spray evaoration in a co-flowing annular jet 68
- 2.1.1 Experimental set-up and inlet conditions 68
- 2.1.2 Thermodynamic properties of isopropyl vapor and liquid 81
- 2.1.3 Discussion of test case results 87

2.2 Particle dropping through a plane horizontal jet 98

- 2.2.1 Experimental set-up and inlet conditions 98
- 2.2.2 Discussion of test case results 101

2.3 Particle dispersion in a lane shear layer 103

- 2.3.1 Experimental set-up 103
- 2.3.2 Flow and inlet conditions 104
- 2.3.3 Test case results and discussion 107
- 2.3.3.1 Small bulk velocity (Ub = 8.5 m/s) 107
- 2.3.3.2 Large bulk velocity (Ub = 17.0 m/s) 124

3 Workshop Presentations 130

3.1 New ideas and methods for modelling dispersed turbulent two-phase flows 130

Invited lecture:

M:W.- Reeks 131

Modelling the constitutive relations for dispersed particles in turbulent flows

M. W .Reeks, K.Hyland, S. McKee, D. Swailes 144

Solutions of a kinetic equation for the transport of particles in turbulent fluid flows

0. Simonin, J. He 154

Eulerian prediction of the particle behavior in a turbulent boundary layer

H. Karema, R. Karvinen 166

The mixing of a passive scalar properties in dilute turbulent gas-particle flows

T.K.McEwan. B.B. Willetts 174

Numerical modelling of wind blown sand: A two-phase system

G. Zivkovic, M. Sommerfeld 182

Numerical calculations of gas-particle flows including particle-particle and particle-wall collisions

N. Daidzic 194

Droplet break-up in turbulent flow fields

V. Christoforou, P. Prinos and A. Goulas 202 Lagrangian modelling of the near-wall fluid-particle interaction

3.2 Direct simulations and large eddy simulations 210

S.E. Elghobashi, G.C. Truesdell 211 Direct numerical simulation of particle-laden decaying turbulence

K.D. Squires, J.K. Eaton 220 Turbulence modelling in particle-laden turbulent flows

F. Ebert, C. Dehning 230 Large eddy simulation of turbulent channel flow of dilute suspensions

3.3 Agglications of numerical methods to relevant engineering problems 250

Invited lecture C.T.Crowe 251 Numerical simulations of industrial applications of sprays

R. Bel F'dhila, 0. Simonin 264 Eulerian prediction of turbulent bubbly flow downstream of a sudden pipe expansion

X. Yang, N.H. Thomas 274 Void fraction profiles in two-phase bubbly upward and downward flows

S. Gaard, H. Brekke 282 Numerical experiments of two-phase bubble flow in an upward pipe

Q.Q. Lu, J.R. Fontain, G. Aubertin 291 A computer code for particle motion in two-dimensional confined turbulent flows

M. Klingsporn, U. Renz 301 Numerical simulation of a Diesel spray

J.L.T. Azevedo, M.G. Carvalho 313 Modelling combustion and fuel-NOx in pulverized coal flames

3.4 Experimental studies phase flows including new measuring techniques 324

Th. Panidis, D.D. Papailiou 325 Water-air bubble grid turbulence in a rectangular channel

R. Bel Fdhila, C. Suzanne, L. Masbernat 335 Two-phase bubbly flow measurements in a vertical sudden expansion C. Hassa, E. Blümcke, M. Brandt, H. Eickhoff 348 Validation experiments for dispersed phase modelling in combusting flows

P. Scotton, A. Armanini 356

Experimental investigation of roughness effects of Debris flow channels

3.5 Measurement accuracies in two-phase flows 364

Invited lecture

G. Gouesbet, G. Grehan, A. Berlemont 365 Critical discussions of modelling and optical instrumentation in dispersed multiphase flows

G. Pitcher, G. Wigley 388 Applications of phase-Doppler anemometry to combusting Diesel fuel sprays -measurement technique, accuracy, and data interpretation

A. Naqwi, M.Ziema, G. Grehan, G. Gouesbet 412 Accuracy considerations in the optical design of phase-Doppler systems

H.-H. Qiu, M. Sommerfeld 421 The impact of signal processing on the accuracy of phase-Doppler measurements

H.P. Bensler, J.M. Delhaye, C. Favreau 431

Uncertainty analysis of the volumetric interfacial area, volumetric void fraction, and Sauter mean diameter in bubbly flows determined by the ultrasonic transmission and photographic techniques

4. References .447

5. List of Participants 449