Int. J. Multiphase Flow Vol. 12, No. 6, pp. 1029–1030, 1986
Pergamon Journals/Elsevier. Printed in Great Britain

ANNOUNCEMENTS

A SHORT COURSE ON TWO-PHASE FLOW FUNDAMENTALS FOR INDUSTRIAL APPLICATIONS

Zurich, 23–27 March 1987

Hosted by the
Swiss Federal Institute of Technology (ETH)
in Zurich

Two-phase flow and boiling heat transfer continue to focus the attention of researchers and to frustrate and challenge the engineer in the chemical, nuclear, oil-and-gas, cryogenic and other industries. New data and information, ideas and hypotheses, and facts and erroneous theories continue to be produced.

The short course described here is patterned after similar courses offered for a number of years at Stanford University and more recently at the University of California-Santa Barbara and at ETH-Zurich. Its intent is to provide:

- A condensed and critical view of present knowledge, including areas of uncertainty
- Transfer of knowledge from one area of applications to another
- Sources of data and correlations
- System analysis and design philosophy and methods

Lecturers

S. BANERJEE, Professor of Chemical and Nuclear Engineering, University of California, Santa Barbara, Calif., U.S.A.
G. HETSRONI, Professor of Mechanical Engineering, Technion, Haifa, Israel.
G. F. HEWITT, Head of the Thermal Hydraulics Division, AERE-Harwell and Professor of Chemical Engineering, Imperial College of Science and Technology, London, England.
T. G. THEOFANOUS, Professor of Chemical and Nuclear Engineering and Director of the Center for Advanced Multiphase Processing and Safety, University of California, Santa Barbara, Calif., U.S.A.
G. YADIGAROGLU, Professor of Nuclear Engineering, Swiss Federal Institute of Technology (ETH), Zurich, Switzerland.

Schedule of Lectures

Monday 23 March

1. Introduction: **G. Yadigaroglu.** Phase equilibria and nucleation. Application of two-phase systems—nuclear, process, aerospace etc. Structure and objectives of course.
2. Fundamental Equations for Two-phase Flow: **S. Banerjee.** Basic variables; void fraction, phase velocities etc. Conservation principles, averaging operations and averaged equations. Multifluid models. Jump conditions. Mixture and drift flux models. Limitations of modelling.
3. Flow Regimes: **G. F. Hewitt.** Flow-regime definitions. Flow-regime maps, specific and general. Phenomena leading to flow-regime transitions; link to multifluid modelling. Flow regimes in systems with phase change.
4. Dispersed Flow Systems: **G. Hetsroni.** Behaviour of single particles, drops and bubbles in a flow field. Interactions between dispersed phase elements. Bubbly flow; drift flux and other models. Void fractions and pressure drop prediction.

Tuesday 24 March

5. Forced Convective Heat Transfer: **G. Hetsroni.** Regimes of heat transfer. Nucleate boiling heat transfer. Forced convective heat transfer. Critical heat flux; parametric effects and correlations.
6. Annular Flow: **G. F. Hewitt.** Liquid film behaviour; velocity profile, interfacial waves. Interfacial friction. Droplet entrainment and redeposition. Prediction methods; applications in adiabatic and diabatic systems.
7. Post-dryout Heat Transfer: **G. Yadigaroglu.** Regimes of post-dryout heat transfer; inverted annular flow, dispersed flow. Wall–liquid interaction and rewetting.
8. Plug, Slug and Churn Flows: **G. F. Hewitt.** Plug flow in vertical tubes. Slug flow; slug frequency, slug behaviour, pressure drop. Churn flow. Churn–annular flow.

Wednesday 25 March

9. Numerical Methods: **S. Banerjee.** Initial and boundary conditions. Method of characteristics. Finite difference methods. Stability, diffusion and dispersion. Explicit and implicit methods. Methods used in computer codes. Fractional time steps and two-step methods.
10. Pipeline Design and Operation: **G. F. Hewitt.** Review of pipeline design problems. Methods for pipeline design. Empirical methods for void fractions and pressure drop. Phenomenological modelling. Computer modelling. Severe slugging.
11. Instability in Vapour Generation Systems: **G. Yadigaroglu.** Classification of instability types. Static (Ledinegg) instability. Density wave oscillations. Applications in the process and nuclear industries.
12. Closure Relationships and Computer Codes: **S. Banerjee.** Closure relationships for multifluid models. Basic requirements for computer codes. Discussion of specific codes for nuclear and process applications.

Thursday 26 March

13. Nuclear Reactor Safety: **G. Yadigaroglu.** Accident sequences; large break, small break. Governing phenomena; critical flow, bypass etc. Emergency cooling systems.
14. Nuclear Severe Accidents: **T. G. Theofanous.** General introduction. Contributing phenomena; core/concrete interactions, dryout in porous media, steam explosions. Examples: Three Mile Island, Chernobyl.
15. Chemical Plant Safety: **S. Banerjee.** General review. Emergency relief systems. Knockout pots and suppression systems. Spills and two-phase jets; dispersion to environment.
16. Two-phase Explosions: **T. G. Theofanous.** Vapour explosions; basic mechanisms, energy conversion, damage potential. BLEVs ("boiling liquid expanding vapour") explosions. Dust and mist explosions; venting.

Friday 27 March

17. Steam Generators: **G. Hetsroni.** Applications of steam generating equipment; non-nuclear, nuclear. Generic problems; corrosion and fouling, tube vibrations. Improved design.
18. Modelling of Aerospace (Microgravity) Systems: **T. G. Theofanous.** Thermal management of space stations; concepts of material processing in space. Two-phase flow regimes. Heat transfer in the presence of boiling and condensation. Thermocapillary phenomena.

Course Fee: S.Fr.1600.

For additional information contact

Professor G. Yadigaroglu
ETH-Zentrum
8092 Zurich, Switzerland
Tel.: (+ +41-1) 256.4615

SECOND INTERNATIONAL CONFERENCE ON LASER ANEMOMETRY
ADVANCES AND APPLICATIONS

University of Strathclyde,
Glasgow, Scotland
21–23 September 1987

The organizing committee invite authors to submit abstracts on topics including:

General applications
Flows with heat transfer
Single-phase fluid mechanics
Two-phase flow studies
New systems and fibre optics
Data processing
Comparisons—computer solution
Measurement and method

Draft papers will be selected on the basis of 300-word abstracts. All papers will be refereed before acceptance.

Deadlines

Abstracts (300 words)	1 December 1986
Draft papers for refereeing	1 February 1987
Final paper	1 June 1987

Abstracts should be submitted to:

LDA Conference
Dr S. M. Fraser
Mechanical and Offshore Engineering
University of Strathclyde
Glasgow G1 1XJ
Scotland