

ANNOUNCEMENTS

TWO PHASE FLOW IN EQUIPMENT

Department of Chemical Engineering
Stanford University

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

The purpose of this course is to provide the practicing engineer with:

- An up-to-date condensed and critical view of the state of knowledge.
- Highlight of salient points.
- Sources of data and correlations.
- Design philosophy and methods.
- The outstanding areas of uncertainties.

The course will consist of:

- A series of coordinated lectures by well known experts.
- Lecture notes to be distributed prior to the course discussions.
- Selected movies and slides to illustrate physical phenomena.
- Excellent and convenient accommodations on Stanford Campus.
- Limited attendance.

Lecturers

S. Banerjee, Professor of Chemical and Nuclear Engineering, University of California, Santa Barbara, Calif.

K. J. Bell, Professor of Chemical Engineering, Oklahoma State University, Stillwater, Oklahoma.

A. E. Dukler, Dean of Engineering, University of Houston, Houston, Texas.

J. R. Fair, Professor of Chemical Engineering, University of Texas, Austin, Texas.

H. K. Fauske, President, Fauske and Associates, Willowbrook, Ill.

G. Hetsroni, Professor of Mechanical Engineering, Technion, Haifa, Israel.

G. F. Hewitt, Head, Engineering Sciences Division, AERE, Harwell, England.

Course Director

G. Hetsroni, Visiting Scholar, Department of Chemical Engineering, Stanford University, Stanford, CA 94305.

MONDAY 10 AUGUST 1981

(1) Introduction—G. F. Hewitt

General philosophy of two-phase flow equipment design. Importance of mechanisms. Balance between use of predictive models and empirical procedures.

(2) Modelling Methods I: Introduction—S. Banerjee

Flow patterns—characterization—basic quantities. Conservation principles and mathematical bases for two-phase models. Mechanisms in boiling and condensation.

(3) Pipeline Systems: Basic Phenomena—A. E. Dukler

Importance of flow regimes. Prediction of transitions. Mechanisms in materials transport.

(4) Pipeline Systems: Design Considerations—A. E. Dukler

Calculation of pressure drop and void fraction. Procedures for different flow regime. Multicomponent gas-liquid systems.

TUESDAY 11 AUGUST 1981

(5) Stream Generators—G. Hetsroni

Classification and description. Design aspects, thermal-hydraulic behavior and materials problems. Flow induced vibrations.

(6) Process Plant Boilers with Boiling on the Tube Side—G. F. Hewitt

Flow regimes, heat transfer and pressure losses. Prediction of dryout. Instabilities. Corrosion and fouling. Design aspects.

(7) Condensers with Condensation on the Tube Side—K. J. Bell

Condensation modes and mechanisms. Equipment description. Heat transfer correlations. Design of tube-side condensers. Non-condensibles. Multicomponent systems.

(8) Condensers with Condensation on the Shell Side—K. J. Bell

Equipment. Correlations for heat transfer and pressure losses. Baffles. Non-condensibles and venting.

WEDNESDAY 12 AUGUST 1981

(9) Process Plant Boilers with Boiling on the Shell Side—G. F. Hewitt

Boiling in tube bundles, and in cross flow. Two-phase flow distribution in complex geometries. Design procedures. Application to waste heat boilers and reboilers.

(10) Other Condensation Equipment—K. J. Bell

Air cooled condensers—arrangements, description and problems. Direct contact condensers. Miscellaneous condenser types—plate fin heat exchangers, special plate exchangers.

(11) Mass Transfer Equipment I: Gas-Liquid Contactors—J. R. Fair

Principles of mass transfer. Film and surface renewal models. Height of transfer with chemical reaction. Methods of estimating mass transfer coefficients and interfacial area. Classification and description of gas-liquid contactors. Design correlations.

(12) Mass Transfer Equipment II: Distillation Equipment—J. R. Fair

Types of distillation systems. Mass transfer on plates. Reboiling and reflux ratios. Entrainment, foaming and other problems. Design aspects.

THURSDAY 13 AUGUST 1981

(13) Mass Transfer Equipment: Liquid/Liquid Contactors—J. R. Fair

Principles of solvent extraction. Equipment and mass transfer correlations. Flooding. Fractional extraction—applications and design procedures.

(14) Modelling Methods II: Computer Codes—S. Banerjee

Examples of two-phase flow models for various processes. Numerical methods of solution. Review of available computer codes.

(15) Modelling Methods III: Evaluation of Model Predictions—S. Banerjee

Limitation of various two-phase flow modes. Phase separation and redistribution in flow networks. Blowdown, refill and rewet. Predictive capability of models in comparison to experiments.

(16) Vapour/Liquid Separation—G. Hetsroni

Classification of separators. Deposition and re-entrainment. Carryover and carryunder—
Experimental results and empirical design procedures. Application of detailed flow structure
models.

FRIDAY 14 AUGUST 1981

(17) Fluid-Structure Interactions in Two-Phase Flow in Equipment—G. Hetsroni

Interaction and structural excitation mechanisms. Damping and mode shape. Experimental
results. Correlations for two-phase flow systems. Design.

(18) Safety Considerations I: Nuclear Fast Reactors—H. K. Fauske

Design aspects. Accidental scenarios and thermalhydraulic behaviour. Two-phase flow of
metal coolants. Fuel-coolant interactions. Sodium aerosols. Vapour explosions.

(19) Safety Considerations II: Chemical Plant—H. K. Fauske

Accidents in chemical plants and the role of two-phase flow. Critical discharge rates and
blowdown. Design aspects of loss prevention.

RESERVATIONS

The course fee, including room and board, is \$800 per registrant. Accommodations will be made
on campus at one of Stanford's students residences (w/o private baths). Three meals per day will be
provided. The course fee EXCLUSIVE of room and board is \$600. Course fee includes printed
lectures.

Please make checks payable to Stanford University. Mail to:

Department of Chemical Engineering
Stanford University
Stanford, CA 94305
U.S.A.

Reservations to be made by 26 June 1981.

NINETEENTH ANNUAL MEETING
OF THE
SOCIETY OF ENGINEERING SCIENCE

OCTOBER 27-29, 1982

University of Missouri-Rolla
Rolla, Missouri, U.S.A.

The Nineteenth Annual Meeting of the Society of Engineering
Science will be held at the University of Missouri-Rolla, Rolla,
Missouri from Wednesday, October 27, through Friday, October 29,
1982. Invited and contributed papers from engineers and scientists
in all fundamental disciplines of engineering sciences will be presented.