SHORT COURSE ON DESIGN AND MODELING OF NATURAL GAS PROCESSES

Four-day short course to be held at The University of Calgary, 25–28 May 1981.

The course is designed for engineers and other professionals who are engaged in the design, and/or processing of natural gases, and will deal with physical, chemical and engineering principles used in the recovery of natural gas liquids from natural gases. Application of these principles to the design of various processes will be stressed. Example calculations bases on recommended design methods will be included.

The structure and use of comprehensive design programs, HYPROP, HYDIS and HYSIM will be discussed in detail. Problem solving sessions are included in which registrants will have opportunities to make use of these programs. No previous knowledge of computers or computer programming is required.

Topic Outline: Introduction; Course objectives and overview of a typical gas processing facility. Phase Behavior and Physical Properties of Natural Gas Systems; Phase diagrams, K-Factor calculation methods, thermodynamic and transport properties of natural gases required in gas plant design. NGL Recovery Processes/Design of Distillation and Absorption Units; Discussion of lean oil, turbo expander, and fractionation processes, Sizing calculations for absorption and distillation columns. Process Configurations for Gas Plants; Heat and material balance calculations for various gas plant flow sheets. Gas Plant Design Problem.

Instructions for the course will be: Dr. P. R. Bishnoi, Dr. W. Y. Svrcek, Department of Chemical and Petroleum Engineering, The University of Calgary; Mr. C. G. Morris, Hypotech Ltd., Calgary, Alberta.

Information regarding course fee and registration procedures can be obtained from: The Faculty of Continuing Education, The University of Calgary, Calgary, Alberta, Canada T2N 1N4. Telphone: Area Code (403) 284–5431.

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 frustate 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 accomodations 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 Contractors—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.

MEASUREMENTS IN POLYPHASE FLOWS

SYMPOSIUM ANNOUNCEMENT AND CALL FOR PAPERS
ASME SPRING MEETING, ST. LOUIS, 7–11 JUNE 1982

1. INTRODUCTION

The objective of the symposium is to provide a forum for presenting and discussion the current status and future needs in the measurement of polyphase flows in fluids engineering. Papers will be accepted for presentation based upon their contribution to the advancement of the state-of-the-art in the areas of:

(a) New measurement techniques or concepts in instrumentation.

(b) Results of experiments done to establish the accuracy and/or precision of measurement techniques or instrument.

(c) New methods or analytical models used to interpret the response of instruments in terms of the physical flow variables.

2. SCOPE

Papers accepted for presentation will be separated into the general categories of:

(1) Flows of gases and liquids.
(2) Flows of gases and solids.
(3) Flows of liquids and solids.
(4) Flows of gases, liquids and solids.

Typical areas of interest include measurements of:

—Temperature
—Pressure
—Velocity
—Mass, momentum of energy flux of two whole flow or its individual components
—Mass, volume, or mole fraction of two components
—Level measurement.

Contribution papers will be accepted from a variety of areas of application including but not limited to combustion, pollution control, processing industries, energy conversion systems and environmental issues.