NATO ADVANCED RESEARCH WORKSHOP ON ADVANCES IN TWO-PHASE FLOW AND HEAT TRANSFER

31 August–3 September 1982

Munich, Federal Republic of Germany

A NATO Workshop on the Advances of Two-Phase Flow and Heat Transfer will be held from 31 August–3 September, 1982, in Munich, Federal Republic of Germany. The participants, limited to 30, will include scientists and engineers who are actively involved in two-phase flow heat transfer research and applications. A limited number of travel and/or subsistence grants will be awarded for the participants from NATO countries. The main topics to be included are: two-phase flow instabilities, advanced computational techniques, two-phase flow heat exchangers, two-phase flow problems in reactor safety. For further information apply to:

Dr. S. Kakaç
Department of Mechanical Engineering
University of Miami
Coral Gables, Florida, U.S.A.
Tel: (305) 284-3288 or 284-4856

FLUIDIZED BED TECHNOLOGY

Stanford University, Department of Chemical Engineering,
16–20 August 1982

Fluidized bed technology continue to provide a focus for the attention of researchers, and to frustrate and thwart the engineer, in chemical and other industries. New data and information, ideas and hypotheses, 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
- Highlights of salient points
- Sources of data and correlations
- Design philosophy and methods
- An outline of 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 the Stanford Campus
- Limited attendance

COURSE DIRECTOR:

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

LECTURERS

T. Fitzgerald TRW Energy Development Group, Redondo Beach, California.
J. R. Grace Professor of Chemical Engineering, University of British Columbia.
G. M. Homsy Professor of Chemical Engineering, Stanford University.
J. M. Matsen Exxon Research and Engineering, Florham Park, New Jersey.
J. Yerushalmi General Manager, PAMA (Energy Resources Development) Tel Aviv, Israel.

Monday, 16 August 1982

1. *Fundamentals I.* Basic phenomena of fluidization; basic equations and incipient fluidization; Liquid–solid and gas–solid systems; particle type classifications (G. M. Homsy).

2. *Fundamentals II.* Onset of bubbling; instability phenomenon; properties of single bubbles; two-phase theory of fluidization (G. M. Homsy).

3. *Mixing.* Solids mixing mechanisms and characterization, segregation of solid species; gas mixing; gas–solid contacting concepts (J. R. Grace).

4. *Flow Regimes I.* Concept of flow regimes; freely bubbling beds; interactions between bubbles; bubble break-up and coalescence; bubble size distributions; slug flow regime and its application (G. M. Homsy).

Tuesday, 17 August 1982

5. *Coarse Particle Systems.* Application; bubbling phenomena; fluidization regime; bed expansion; gas and solid mixing; heat transfer (T. Fitzgerald).

6. *Entrainment*: Definitions; mechanisms of entrainment and disengagement; theoretical relationships; effect of operating and system variables; carryover (J. M. Matsen).

7. *Pneumatic Conveying.* Dense phase conveying through pipes and orifices; solids circulation through standpipes and between vessels; solids feeding and recycle (J. M. Matsen).

8. *Heat Transfer.* Gas–solid heat transfer; bed-to-surface heat transfer; packet theory; large particle heat transfer; correlations; effect of parameters; radiation (J. R. Grace).

Wednesday, 18 August 1982

9. *Instrumentation I.* Introduction to measurements; intrusive and non-intrusive probes; global and local measurements (T. Fitzgerald).

10. *Instrumentation II.* Relationship between measurements and bed behavior; modern measurements of bubble size, velocity and frequency; measurements of temperature and heat transfer coefficients (T. Fitzgerald).

11. *Design and Scale Up.* Critical parameters; scale up; attrition and erosion; baffles and internals; distributors (J. Matsen).

Thursday, 19 August 1982

12. *Modeling of Chemical Reactors I.* Gas–solid contacting; models for solid-catalyzed gas phase reactions; use of models for scale-up and control (J. R. Grace).

13. *Modeling of Chemical Reactors II*: Gas–solid reactions; complex kinetics; incorporation of heat effects; advanced models (J. R. Grace).

14. *Gas Jets.* Jetting phenomena; grid jets; mechanism of bubble formation; particle mixing (G. M. Homsy).

Tour of Stanford Research Facilities.

15. *Flow Regimes II.* Turbulent and fast fluidization regimes; stability considerations; clusters (J. Yerushalmi).

16. *Gasification of Coal.* Winkler gasifier; post-war gasifiers; three-stage gasifiers and various processes; operation aspects of gasifiers (J. Yerushalmi).

17. *Combustion of Coal and Oil Shale.* Combustion of coal in various applications; Ignifluid and other combustion devices; design and operating difficulties; utilization of limestone (J. Yerushalmi).

Reservations
Please return by 2 July 1982

☐ The course fee, including room and board, is $900 per registrant. Accommodations will be made on campus at one of Stanford's student residences (w/o private baths). Three meals per day will be provided.

☐ The course fee EXCLUSIVE of room and board is $700. I will be planning my own accommodations.

Course Fee Includes Printed Lectures

Please make checks payable to Stanford University, Detach and mail to:
Department of Chemical Engineering
Stanford University
Stanford,CA 94305, U.S.A.

Name _____

Affiliation _____

Address _____

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Phone _____