

Announcing the 43rd offering of

# FLUID FLOW PROJECTS

## "TWO-PHASE FLOW IN PIPES"

### Instructors

**Dr. Cem Sarica**  
**Dr. Eduardo Pereyra**



THE UNIVERSITY of  
**TULSA**  
*Continuing Education for  
Science & Engineering*

A STATE-OF-THE-ART

**SHORT COURSE**

**May 7-11, 2018**  
**TULSA, OKLAHOMA**

**University of Tulsa Campus, Henneke Building, 1204 S. Harvard**  
The short course is scheduled from 8:30 a.m. to 5:00 p.m.,  
Monday-Thursday and from 8:30 a.m. to noon on Friday.

### ABOUT THE INSTRUCTORS

**DR. CEM SARICA**, F.H. "Mick" Merelli/Cimarex Energy Professor of Petroleum Engineering at The University of Tulsa (TU) holds a Ph.D. in Petroleum Engineering from TU. His current research interests are multiphase flow in pipes, oil and gas production, and flow assurance. He is currently serving as the director of TUFFP, Tulsa University Paraffin Deposition Projects (TUPDP) and Tulsa University Horizontal Well Artificial Lift Projects (TUHWALP). He is the recipient of the 2010 SPE International Production and Operations Award, recognized as a Distinguished Member of SPE in 2012. Cem received the SPE John Franklin Carll Award and SPE Cedric K. Feguson Certificate in 2015.

**DR. EDUARDO PEREYRA**, Assistant Professor of Petroleum Engineering and Associate Director of Fluid Flow and Horizontal Wells Artificial Lift Projects at The University of Tulsa. He also has worked as a research scientist intern at Chevron's advanced production technology / subsea technology unit focusing conventional separators performance. His research interests are multiphase flow systems and transport, flow assurance, and separation technologies. He received his PhD. and Master's degree in petroleum engineering from The University of Tulsa and two BS degrees (Mechanical and Systems Engineering) from The University of Los Andes, Merida Venezuela.

Multiphase flow of oil-gas-water is inevitable and presents unique challenges in operation for any production and transportation system, including horizontal wells drilled into unconventional plays. Therefore, an improved understanding of multiphase flow in wells, flowlines, and risers is of vital importance to engineers and industry professionals.

**The completed and current research projects conducted at the Tulsa University Fluid Flow Project (TUFFP) permits teaching the latest techniques for designing multiphase flow systems in this program.**

TUFFP is currently pursuing several projects simultaneously studying the effects of size and pressure upscaling and liquid viscosity on multiphase flow behavior utilizing state of the art facilities and instrumentation. The information will be shared with those attending the May 2018 course. Summaries of the current TUFFP projects are provided at [www.tuffp.utulsa.edu](http://www.tuffp.utulsa.edu).

## COURSE OUTLINE

### PRINCIPLES OF TWO-PHASE FLOW

- Single-Phase Flow Review
  - Conservation laws
  - Mechanical energy balance equation
  - Heat balance equation
  - Evaluation of friction losses
- Two-Phase Flow Introduction
  - Definition of basic variables
  - Two-phase flow pressure gradient equation
  - Flow patterns
  - Computing algorithms

### PVT PROPERTIES

- Mass Transfer Models
  - Black oil model
  - Compositional model
- Density of Oil, Water, Gas
- Viscosity of Oil, Water, Gas, Emulsions
- Surface Tension

### FLOW IN WELLS

- Flow Pattern Prediction Modeling
- Pressure Loss and Holdup Prediction
  - Models and Correlations
- Evaluation of Pressure Loss Methods

### FLOW IN PIPELINES

- Flow Pattern Prediction Modeling
- Pressure Loss and Holdup Prediction
  - Models and Correlations
- Evaluation of Methods
- Effects of Hilly Terrain
- Slug Flow Modeling

### FLOW THROUGH RESTRICTIONS

- Basic Equations
- Critical vs. Subcritical Flow
- Critical Flow Correlations
- Subcritical Flow Correlations

### UNIFIED MODELING

- Model Development
- Model Evaluation

### FLOW ASSURANCE

- Wax Deposition
  - Deposition Modeling
  - Prevention and Remediation
- Severe Slugging
  - Phenomena
  - Mechanisms
  - Elimination Methods

## This course features . . .

- An appropriate balance will be maintained between lectures and problem solving, and between theory and application.
- Problem-solving sessions are dispersed throughout the course to enhance the understanding of variables unique to two-phase flow.
- Information on the latest TUFFP studies.
- Computer algorithms are presented so that you will be able to develop your own programs upon completion of the course.
- You will receive the SPE monograph on "Multiphase Flow in Wells" and an extensive workshop manual.
- A tour of TU's North Campus Multiphase Flow and Flow Assurance Experimental Test Facilities (weather permitting).
- A scientific calculator will be provided.

## This course is designed for . . .

Systems Engineers, Process Engineers, Operations Engineers, Facilities Engineers, Reservoir Engineers, Production Engineers, Petroleum Engineers, Flow Assurance Engineers, Technical Consultants, Chemical & Mechanical Engineers, and anyone who handles multiphase flow systems.

Participants should be familiar with basic fluid mechanics and properties; along with hydrocarbon systems vapor-liquid equilibrium and computer programming. No experience in two-phase flow is required for attendance.

**"This course offers the attendee a unique opportunity to learn the fundamentals of multiphase flow technology from the industry experts who develop the technology."**

— R. S., Technical Consultant, Marathon Oil

**"I gained many useful tools and insights about multiphase flow from this course that will be beneficial to me in my job."**

— R. R., Project Engineer, Baker Hughes, Inc.

**"The course is very well organized and I now have a much deeper understanding of multiphase flow. The course clarifies the theories behind software interface."**

— S. C., SGS Upstream Services

**"An excellent short course on problem solving techniques to resolve your multiphase flow issues and understand the limits of the solutions."**

—K. L., Process Engineer, Chevron

**"This course definitely accelerated my understanding of fluid flow & flow assurance analysis. It was a great time investment."**

— K.C., FA Engineer, ExxonMobil

## WHAT IS TUFFP ?

The **Tulsa University Fluid Flow Projects (TUFFP)** is a cooperative industry-university research group supported by oil and gas production, service companies and government agencies. TUFFP conducts applied research on fluid flow problems encountered by the member firms.

## Doubletree Hotel, 6110 S. Yale, 918-495-1000

A block of sleeping rooms has been reserved at the Doubletree Hotel at Warren Place, 6110 S. Yale. for participants attending this course needing overnight accommodations. After registering for the course, you will receive information on making your hotel reservations. A TU shuttle will provide daily transportation to and from the hotel and the TU campus.



# FLUID FLOW PROJECTS

## SHORT COURSE "TWO-PHASE FLOW IN PIPES"

☐ **Yes!** Please enroll the following in the **May 7-11, 2018**, Tulsa, Oklahoma offering of **FLUID FLOW PROJECTS: "TWO-PHASE FLOW IN PIPES" Short Course**

FIRST NAME	LAST NAME		
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JOB TITLE			
<input type="text"/>			
ORGANIZATION / COMPANY NAME			
<input type="text"/>			
ADDRESS			
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CITY	STATE	ZIP	COUNTRY
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PARTICIPANTS PHONE			
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PARTICIPANTS EMAIL			
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### COURSE FEE SCHEDULE

Online Registration available at [www.cese.utulsa.edu](http://www.cese.utulsa.edu) (credit card payments only)

**SELECT ONE** — fees listed are per person and in net US Dollars:

#### TUFFP & TUPDP Member Company per person fees:

- ☐ **\$2,295.00 ... GROUP DISCOUNT** (available to 2 or more from the same company)
- ☐ **\$2,295.00 ... EARLY REGISTRATION DISCOUNT** (expires April 13, 2018)
- ☐ **\$2,795.00 ... REGISTRATION FEE AFTER APRIL 13, 2018**

#### Non-Member Company per person fees:

- ☐ **\$2,795.00 ... GROUP DISCOUNT** (available to 2 or more from the same company)
- ☐ **\$2,795.00 ... EARLY REGISTRATION DISCOUNT** (expires April 13, 2018)
- ☐ **\$3,295.00 ... REGISTRATION FEE AFTER APRIL 13, 2018**

### PAYMENT METHOD

- ☐ **CHECK ENCLOSED** Make payable to The University of Tulsa, CESE
- ☐ **VISA** ☐ **MasterCard** ☐ **Discover** ☐ **American Express**

CREDIT CARD NUMBER	EXP. DATE (MM/YY)	CVC CODE	
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NAME ON CARD			
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BILLING ADDRESS			
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☐  
CHECK  
IF BILLING  
ADDRESS IS  
THE SAME  
AS ABOVE

To enroll, complete and return the enrollment form with payment to:

#### The University of Tulsa – CESE

800 S. Tucker Dr., Tulsa, OK 74104-3189

Fax: 918.631.2154

Phone: 918.631.3088

Email: [cese@utulsa.edu](mailto:cese@utulsa.edu)

Online registration: [cese.utulsa.edu](http://cese.utulsa.edu)

(credit cards only)

#### COURSE FEE

The seminar fee covers the cost of all sessions, handout materials, textbook, electronic workshop manual, guided tour of TU's experimental facilities, reception and daily refreshments. The fee is to be paid in net U.S. dollars.

#### MEMBER COMPANY DISCOUNT

Available to those companies enrolled in TUFFP (Tulsa University Fluid Flow Projects) and TUPDP (Tulsa University Paraffin Deposition Projects).

#### GROUP DISCOUNT

Group discounts are available to groups of two or more attending from the same company location.

#### EARLY ENROLLMENT

Sign-up for the short course before April 13, 2018 to receive the discounted rate.

