Dr. Muthanna H. Al-Dahhan
Professor and Chairman, Department of Chemical and Biochemical Engineering
Professor of Nuclear Engineering
Missouri University of Science and Technology – Rolla
Rolla, Missouri 65409-1230
aldahhanm@mst.edu, Tel: 573-341-4416 and 573-341-7518, Fax: 573-341-4377
Mobiles: 314-498-9662 and 573-578-8973

EDUCATION

1993	Doctoral degree	Chemical Engineering, Washington University in St. Louis, Missouri, USA
1988	Master degree	Chemical Engineering, Oregon State University, Oregon, USA
1979	B.S. degree	Chemical Engineering, University of Baghdad *(Graduated the first out of 136 graduates in the department and among the top 5 out of more than 1000 graduates in the engineering college consisted of 9 engineering departments, University of Baghdad)*

RESEARCH INTERESTS

The research activities focus on sustainable energy and environment and are related to: 1) Advancing the knowledge and understanding of multiphase and multi-scale reaction engineering, reactors, flow systems and processes via advanced measurement, modeling and computational techniques; 2) Modeling of transport (momentum, mass, heat), kinetic and their interactions; 3) New methodologies of scale-up of multiphase reactors and flow systems and their energy efficient and environmentally responsible design and performance; 4) Development of advanced process measurement and monitoring techniques including radioisotopes and non-radioisotopes based techniques and their applications in imaging and visualization of complex opaque industrial systems; 5) Benchmarking and assessing the validation of computational fluid dynamics (CFD) models and simulations and reactor scale performance models; 6) Thermal-Hydraulic of the 4^{th} generation nuclear energy, small modular reactors (SMRs) and the 3^{rd} generation light water reactors; and 7) Sustainable development via advancing the knowledge and investigating various multiphase processes related to sustainable energy and environment such as production of clean energy, bio-energy, fuels, products, chemicals, and petrochemicals, petroleum processes, biomass and coal conversion and their clean utilization, wastes treatment, animal and farm wastes treatment via anaerobic digestion, environmentally responsible and risk free proliferation nuclear energy, etc.

PROFESSIONAL EXPERIENCE

January 2009 – Present	Professor with tenure and Chairman, department of Chemical and Biological Engineering, Professor of Nuclear Engineering, Missouri University of Science and Technology, Missouri, Rolla
January 2009 – 2012	Affiliated Professor, Department of Energy, Environmental and Chemical Engineering (EECE), Washington University in St. Louis, Missouri
2008 – 2011	Affiliated Professor, department of Chemical engineering, Laval University, Quebec, Canada
July 2011-December 2012	Visiting Professor, Sustainable Energy and Technology Center (SET), King Saud University, Saudi Arabia
January-December 2011	Consultant for strategic planning – Kuwait Institute for Scientific Research (KISR) – Kuwait

2007 – Present	Expert for IAEA scientific missions/meetings (International Atomic Energy Agency)
1999 – Present	Consultant to energy and chemical industry
2011 – Present	Expert, UN-UNESCO on quality assurance of engineering education
September 2006 – Dec. 2008	Professor with tenure, Department of Energy, Environmental and Chemical Engineering (EECE), Washington University in St. Louis, Missouri
September 2005 – August 2006	Professor with tenure, Department of Chemical Engineering, Washington University in St. Louis, Missouri
September 2002 – August 2005	Associate Professor with tenure, Department of Chemical Engineering, Washington University in St. Louis, Missouri
September 1999 – August 2002	Assistant Professor on tenure track, Department of Chemical Engineering, Washington University, St. Louis, Missouri *(no starting package and no graduate student(s) were supported by the school)*
2003 – 2008	Co-Director of the Chemical Reaction Engineering Laboratory (CREL), EECE Department, Washington University in St. Louis, Missouri
2003 – 2008	Co-Leader, NSF Engineering Center – Center for Environmentally Beneficial Catalysis (CEBC) – Washington University (Co-Partner) with University of Kansas (Head Quarter, PI), University of Iowa and University of Prairie View A&M (Co-Partners)
1999 – December 2008	Director of the Clean Alternative Energy using Slurry Bubble Column Reactors (CAE-SBCR) Consortium for the technological development of gas-to-liquid fuel (GTL) conversion from natural gas and biogas (methane), coal and biomass; Academic Partners (Washington University, Ohio State University (Prof. L.S. Fan) and Rensselaer Polytechnic Institute (Profs. Steven Antal and Richard Lahey); Industrial sponsors (DOE via Air Products and Chemicals (1999-2003), ConocoPhillips (USA), Eni Technology (Italy), Johnson Matthey Catalyst (UK) (2006-2008), Sasol (South Africa), Statoil (Norway))
September 2005 – August 2006	UDCT Golden Jubilee Visiting Fellow, University Institute of Chemical Technology (UICT, previously UDCT), University of Mumbai, Mumbai, India
September 1994 – August 1999	Assistant Professor (part-time), Department of Chemical Engineering, Washington University in St. Louis, Missouri
September 1994 – 2003	Associate Director of CREL, Department of Chemical Engineering, Washington University, St. Louis, Missouri
April 1994 – August 1994	Adjunct Assistant Professor, Department of Chemical Engineering, Washington University in St. Louis
October 1993 – March 1994	Project Manager, Xytel Corporation, Mt. Prospect, Illinois
June 1991 – September 1993	Instructor, Department of Chemical Engineering, Washington University in St. Louis, Missouri
September 1988 – September 1993	Graduate Research Assistant and Teaching Assistant, Washington University in St. Louis, Missouri
January 1986 – June 1988	Graduate Student and grader, Oregon State University, Corvallis, Oregon
June 1983 – July 1985	Head of the Chemical Process Development Section, Laboratory and Pilot Plants Research Center for Process Development, Baghdad
January 1982 – May 1983	Process Engineer, Laboratory and Pilot Plants Research Center for Process Development, Baghdad
December 1979-August 1980	Trainee on process engineering and development, Snia-tech, Italy

September 189 – December 1981	Project Engineer, Design and Construction Division, Laboratory and Pilot Plants Research Center for process Development, Baghdad
June 1978-September 1978	Trainee, Borovo tire and Plastic processes, Previous Yugoslavia (Serbia/Croatia).

SCHOLARLY ACTIVITIES at GLANCE

PUBLICATIONS ***(See the list below after the section of services)***

Peer Reviewed Journals: 153 Papers
Reviewed Proceedings: 62 papers
Non-Reviewed Proceedings: 13 papers
Total: 228
Submitted and under preparation: Many papers
Technical Reports: Numerous monthly, quarterly and final reports to Federal and Industrial sponsors
Citations for '*Muthanna Al-Dahhan'*: 2147 (Ref. Google Scholar, November 2012)
Cited Publications: 84
H-Index: 25

Note: One article has received 1551 full-text downloads since date of posting (2007-08-19) till (2012-02-09)
http://www.bepress.com/ijcre/vol5/R1

PRESENTATIONS ***(See the list below)***

Invited keynote and plenary lectures: 30 *(See the list before publications)*
Invited lectures: 98 *(See the list after publications and before conference presentations)*
Conferences Presentations: 357 *(See the list after invited talks)*
Total: 485

Dow Chemicals adopted my development of liquid-liquid contactor for mass transfer and reaction studies to be used in their new chemical processes development which has been introduced as Al-Dahhan Cell

LEADERSHIP

- Participated on raising over $8 million from private sector (Alumni and corporates) for the new building of the chemical and biochemical engineering department.
- Leading the department involvement for the steps of designing and process on construction of the state-of-the-art new building (laboratories and classrooms) for the chemical and biochemical engineering department.
- Leading the chemical and biochemical engineering department since January 2009, restructuring its undergraduate and graduate programs, and developing and implementing new vision and strategic plan to expand into new areas and adding new faculty members which have facilitated raising the external fund to make new building a reality.
- Leading the development and research activities of a unique research laboratory in USA and in the world on advancing multiphase and multi-scale processes from January 2009 to present.
- Leading the development and implementation of industrial consortiums on clean alternative energy at Washington University in St. Louis from 1999 to December 2008; Partners are Ohio State University and Rensselaer Polytechnic Institute and five international companies (Air Products and Chemicals (USA), ConocoPhillips (USA), ENI (Italy), Sasol (South Africa), Statoil (Norway), Johnson Matthey (UK)).

- Co-leader in NSF – Engineering Research Center on Center for Environmentally Benign Catalysis (CEBC) – University of Kansa, from 2003 to 2008
- Director of the research program funded by DOE in partnership with Oak Ridge National Laboratory team on biogas production from animal and farm wastes from 2001-2007.
- Co-leading the expansion and operation of the chemical reaction engineering laboratory as industrial consortium at Washington University from 1993 to December 2008.

LEADERSHIP TRAINING

- Participated in MU-Leadership Development Program (LDP) and received leadership certificate for successful completion in 2010/2011 organized by University of Missouri System.
- Participated in a training workshop on chairing academic department organized by American Council on Education (ACE), San Diego, California, February 24-27, 2010.
- I was selected and Participated in 2009/2010 leadership development program of University of Missouri.
- Participated on training session for academic department chairs, April 19, 2009, Council for Chemical research, CCR.
- Participated in a training workshop on chairing academic department organized by American Council on Education (ACE), San Diego, California, February 24-27, 2010.
- Participated in 2009/2010 leadership development program of University of Missouri.
- Participated on training session for academic department chairs, April 19, 2009, Council for Chemical research, CCR.

CONTINUING EDUCATION

- Participated in a short course on Fischer-Tropsch (FT) Catalysis (2006), Utah, Dr. Calvin Bartholomew.
- Participated in a short course on Multiphase Flow Reactors and Modeling (2004), Dr. V. Ranade of National Chemical Laboratory, India, at Washington University, Chemical Engineering Department).
- Participated in a short course on computational fluid dynamics (CFD) (2003, Professor H. Kuipers of University of Twente, The Netherland, at Washington University, Chemical Engineering Department)
- Short course on chaotic analysis (2002, Professor M. Cassenello of University of Buenos Aris, Argentina, at Washington University, Chemical Engineering Department)
- Chemical Engineering Summer School – Workshop on Chemical Engineering Education, Snowbird, Utah, Summer 1997
- Autoclave Engineering Inc., Workshop on design and development of laboratory reactors, Pennsylvania, Erie, June 1989
- SNIA Co., 8 months training as project engineer on different technical and engineering topics related to process design and development, equipment selection, process operation and safety, etc., December 1979 – July 1980
- Borovo Co., Yugoslavia, Internship on chemical processes awarded to the best undergraduate student in the engineering school, July 1978 – September 1978
- Petrochemical Co., Basra, Iraq, Internship on petrochemical processes, June 1978 – July 1978

TEACHING

COURSES, LABORATORIES AND TEXT MATERIALS DEVELOPED AND TAUGHT

ABET

- Chairing ABET committee and I have led the effort toward obtaining ABET accreditation and for developing, implementing and assessing well-structured assessment plans for students' outcomes,

program educational objectives and continuing improvements. Supervised the implementation of all the needed ABET assessments and co-authored the reports.

- June 2011- Present: I was selected by UN-UNESCO to be expert on the development of quality assurance of the engineering education in Iraq. Participated in providing workshops, reviewing self-study reports, site visits, panels, etc. I worked with 4 experts from UK, Ireland, Australia and US which further enriched my experience and knowledge.
- Provided training session on how to establish quality assurance toward obtaining ABET accreditation to University of Technology, Baghdad, Iraq – December 31, 2013.
- Selected and invited (February 2009) by UiTM (Universiti Teknologi Mara), Shah Alam, Malaysia to review the chemical engineering department program and curriculum for ABET accreditation.
- Participated since 1995 on ABET review preparation process and report preparation. Prepared documents for the undergraduate labs and the courses needed for ABET evaluation in 2000 and 2006 and the related visits. Prepared the undergraduate labs section for ABET case study report submitted by the department for ABET evaluation.

COURSES TAUGHT AND DEVELOPED

Missouri S&T

- Taught and developed part (6 weeks) of new course NE301 – Radiochemistry and Nuclear Forensic – Spring Semester 2012. The development of the course was financially supported by NRC as Co-PI (Nuclear Regulatory Commission) (Other instructors: C. Castano (PI), S. Usman (Co-PI) and H. Lee (Co-PI)
- Taught and developed experimental course, ChE301 – Fall 2011, on "Modeling and Computing in Chemical and Biological Engineering" for graduate students and as technical elective for senior undergraduate students
- Taught since Spring Semester 2010 and also developed new notes for Chemical Reactor Design, ChE 383, required for graduate students and elective for senior undergraduate students
- Taught Engineering Ethics "ChE 211" required for undergraduate students in Spring Semester of 2011 and currently overseeing the course
- Taught Fluid Flow/Mechanics course, ChE 233, required for undergraduate students in Fall Semester of 2010

Washington University in St. Louis

- Developed in Fall Semester of 2006, 2007 and 2008 the structure and the text materials for "ChE 553/453: Bioprocess Engineering: I-Fundamentals and Applications". The course is for graduate and senior undergraduate students in Energy, Environmental and Chemical Engineering – Washington University. It was one of the requirements for the Bioprocessing Track in Chemical Engineering for undergraduate. It was structured to attract students from other disciplines. Many students from Biomedical Engineering and other disciplines took it from 2006 to 2008.
- Developed the structure and the materials for "ChE 275: Modeling and Computing in Chemical and Biological Engineering". The course is one of the requirements for ChE undergraduate students.
- Co-instructor (Fall 2005) and developed part of the materials for the Bio-Catalysis course (ChE-593) for graduate students of the National Science Foundation (NSF) - Center for Environmentally Beneficial Catalysis (CEBC) (University of Kansas, Washington University and University of Iowa).
- Developed and taught (Fall 2004) the Bio-catalysis and Bioreactors lectures for the special topic course "Reaction Engineering for the Environmentally Benign Processes" for graduate students of the National Science Foundation (NSF) - Center for Environmentally Beneficial Catalysis (CEBC) (Washington University, University of Kansas and University of Iowa)
- Successfully spearheaded and implemented the revamping of the capstone design course and created industrial mentoring program by engaging students on design projects on real industrial processes at the local industry premises (The participant companies: Solutia, Monsanto-Enviro Chem, ConocoPhillips Refinery, Mallinckrodt, EHV-Weidmann Industries, SIU bioethanl pilot plant). The success in this led

to the creating a new elective course for undergraduates called "Industrial Mentoring". It has been first implemented under my supervision (Bucky Akinyeni, spring 2005, Biofules of Missouri, Inc.).

- Developed the structure and materials/text notes for CS-265-2 (Fall 1991-2006) "Introduction to computing and computer applications". The course is required from all engineering undergraduate students including chemical engineering students.
- Developed the structure and materials for undergraduate chemical engineering laboratories I and II (ChE 374 and ChE 473) (i.e., equivalent to unit operation labs) (Fall 1994-2006).
- Developed the structure and materials of the process engineering components lectures as a part of the chemical engineering laboratory courses I and II (ChE 374 and ChE 473).
- Restructured the two courses of the Chemical Engineering Laboratory (ChE 374 and ChE 473) into one course (ChE 473A) that is flexible enough to benefit the students in the all developed four tracks of the revised ChE undergraduate curriculum (Bioprocessing, Environmental, Materials and Product and Process Development Tracks).

SHORT COURSES AND WORKSHOPES FOR INDUSTRY AND ACADEMIA

- Taught short course on Multiphase Reactors Engineering and Technology to Engineers and Scientists with PhD, MS and BS degrees from Kuwait Institute for Scientific Research (KISR) and from refineries of Kuwait National Petroleum Company (KNPC), December 22-26, 2013
- 2011-Present: A member of a team of 5 experts selected by UNESCO who have been offering workshops on quality assurance in engineering education to Deans, Chairmen and faculty members of Iraqi engineering colleges. I was selected by UN-UNESCO as an expert to establish Quality Assurance (QA) in Engineering Education in Iraq. The experts are from USA, England, Ireland, and Australia. The workshops were offered in Doha, Qatar (June, 2011), Erbil, Kurdistan-Iraq (June, 2012 and February, 2014), Amman, Jordan (October, 2013), Beirut, Lebanon (October, 2011)
- Provided training session on how to establish quality assurance toward obtaining ABET accreditation to University of Technology, Baghdad, Iraq – December 31, 2013.
- Participated and the key speaker in the National Workshop on Applications of Nuclear Techniques in Industry Sponsored by IAEA and KISR-Kuwait, June 25-26, 2013
- Taught a 4-days workshop on ABET accreditation and its process and requirements to University of Tikrit, Iraq, December 2012
- Developed and taught two short courses for Industry on "Multiphase Reaction Engineering Principles" taught to ChevronPhillips Chemical, Houston, TX (January 2008) and "Multiphase Reactors Engineering and Technology" taught to Syntroleum, Tulsa, OK) (April, 2006), Sasol Inc. (South Africa) (September, 2006), ADM (2006), ExxonMobil, Fairfax (March 2007) and Clinton (April 2007), Eastman Chemicals (March 2007), Rentech, Denver, CO, (July 2007), Chevron (March 2008).
- Developed and taught two weeks short course on gamma ray computed tomography in Malaysia sponsored by International Atomic Energy Agency (IAEA) for Nuclear Malaysia engineers and scientists and graduate students of Malaysia National University (May 2008).
- Developed and taught one week short course on industrial applications of radioisotopes for imaging and visualization in Korea – Daejeon (Korea Atomic Energy Research Institute, KAERI) sponsored by International Atomic Energy Agency (IAEA) for engineers, scientists, faculty, and graduate students (July 6 – 10, 2009).
- Taught one week short course on gamma ray computed tomography in India – Bangalore sponsored by University of King Abdulaziz – Jeddah for training engineers and faculty December 21-25, 2009.
- Invited and Participated in a short course for Professional Engineers (Missouri and Illinois engineers) organized Half Moon LLC on Exploring Waste-to-Energy Technologies covering "Anaerobic Digestion of Animal and Farm Wastes For Bio-Energy Production and Clean Environment", Crown Plaza Clayton, Clayton, MO, July 13, 2010
- Offered and developed a short and intensive course on radioisotopes applications in industry to Asia scientists and engineers sponsored by IAEA (International Atomic Energy Agency), conducted in

Nuclear Malaysia - July 19th-23rd, 2010. Scientists and engineers from 12 Asian countries attended the course.

- Offered and developed a workshop on research methodologies to Iraqi Scientists sponsored by Ministry of Science and Technology, Baghdad, December 2010. Over 50 scientists and engineers attended the workshop.
- Taught as a part of the short course on advanced industrial imaging and visualization - 3rd World Congress on Industrial Process Tomography – Banff, Canada, 1st – 5th, September 2003.

NEW LABORATORY EXPERIMENTS DEVELOPED FOR UNDERGRADUATES

Missouri S&T

- Spearheaded the effort of obtaining Emerson/Mynah donation for establishing state-of-the-art multidisciplinary process control lab and virtual experiments using Emerson industrial DeltaV process control system to be integrated with undergraduate unit operations experiments.
- I have been co-leading the effort with Dr. Sitton to rebuilding undergraduate unit operations lab with new experiments and to raising the needed funding for that (e.g., ConocoPhillips experiment)

Washington University in St. Louis

- Supervised a ChE graduated student (David Kettler) for the development of web-based operated experiment for undergraduates. The experiment can be run and the data can be collected, downloaded and processed via the internet. The Experiment has been used by students since Spring Semester 2003.
- Supervised undergraduate students for the development of two set-ups (1 liter and 37 liter) for Bio-energy based open-ended experiment for bioethanol production. The experiment has been used by the students since 2002.
- Supervised the development of the thermal polymer coating via fluidization experiment which has been used by the students since 2002.
- Supervised the development of the energy and heat exchanging experiment to be operated via the internet.
- Developed and implemented an innovative interactive learning approach for the open-ended bioenergy based experiment which has been introduced in 2004 and recently presented in 229th ACS annual meeting (2005) – Green chemical education.
- Incorporated research facilities into undergraduate chemical engineering laboratory courses.

CURRICULUM

Missouri S&T

- Working with faculty on improving the undergraduate and graduate curricula
- Worked with faculty on establishing improved computer labs and undergraduate labs
- Empowered faculty to develop graduate certificate on safety engineering and courses to be accessed by the interned.
- Outreached to Fort Leonard Wood - proposing with faculty undergraduate and graduate certificates

Washington University in St. Louis

- Spearheaded the Product and Process Development Track as one of the newly developed four tracks for the ChE undergraduate program (the other tracks are: bioprocessing, environmental and materials).
- Participated in the revamping (2004-2005) of ChE undergraduate curriculum that created four tracks (Bioprocessing, Environmental, Materials and Product and Process Development Tracks).
- Participated in the revamping (2005) of the ChE graduate program.
- Participated in the revamping of the ChE undergraduate curriculum to fulfill the need of the newly developed department in 2006 (EECE).

TEXT NOTES AND TEACHING MANUALS DEVELOPED

Missouri S&T

- Developed notes for Chemical Reactor Design course, ChE 383, required for graduate degrees and elective for senior, Spring Semester 2010.
- Developed notes for modeling and computing in chemical and biological engineering course, ChE 301, for graduate students and technical elective for undergraduate senior students

Washington University in St. Louis

- Developed "ChE 553/453: Bioprocess Engineering: I-Fundamentals and Applications".
- Developed "ChE 275: Modeling and computing in Chemical and Biological Engineering". It includes introduction to process modeling, numerical techniques, Matlab functions and programming and spreadsheet function and programming for solving engineering problems.
- Developed "CS 265- section2: Introduction to Computing and Computer Applications"
- Developed Module 5 (Introduction to Biological Reactions and Reactors) and Module 8 (Cells Growth, Kinetics and Biocatalysts Test Beds) for the NSF-CEBC across universities (University of Kansas, Washington University, University of Iowa, University of Prairie View A&M) course "Reaction Engineering for Environmentally Benign Processes" which was taught in fall 2004 through video conference technology.

Text notes/manuals have been developed for use by the students:

Washington University in St. Louis

- Developed a comprehensive new materials/text notes for the "ChE 553/453: Bioprocess Engineering: I-Fundamentals and Applications" based on 7 text books related to the field.
- Developed the structure and the materials for the "Chemical Engineering Laboratory I (ChE 374 – Heat, Mass-Momentum Transport)"
  The **developed manual** contains detailed information related to the following experiments: cooling tower, heat transfer coefficient, heat exchangers, batch distillation, pump characteristics, pressure drop in pipes, pressure drop in packed beds, thermal coating by fluidization, tracer experiment for flow reactors.
- Developed the structure and the materials for the "Chemical Engineering Laboratory II (ChE 473 – Thermodynamics, Transport and Reaction Engineering)"
  The **developed manual** contains detailed information related to the following experiments: vapor-liquid equilibrium, continuous distillation, forced circulation evaporator, membrane separation of gas mixture, absorption with chemical reaction, continuous flow reactors, and bioenergy – bioethanol production,
- Developed technical manual for ChE 374/ChE 473 related to the "Process Engineering Components"
  The **developed manual** contains details on process safety, standard codes, piping, valves/regulators, steam traps, instrumentation and measurement devices, electrical power generation and distribution, pumps, compressors, blowers, fans, vacuum and ejectors systems, agitators and mixers, mechanical separators and filters, corrosion and corrosion control.
- Developed the structure, contents and the materials for the "Introduction to Computing and Computer Applications (CS 265 – Section 2)"
  The **developed notes (materials)**:
  Part I: Numerical Computing methods**,** C++ Programming, Fortran Programming
  Part II: Matlab functions and programming and Spreadsheet – Excel for solving engineering problems

SAFETY

Missouri S&T and Washington University in St. Louis

- Developed protocols and procedures for safe operation and handling radioisotopes based advanced techniques for flow visualization

Washington University in St. Louis

- Established a safety minute before any weekly seminar in the Chemical Reaction Engineering Laboratory (CREL) – Washington University to be given by a designated student/coworker.
- Created with Environmental, Health and Safety (EH&S) office of Washington University a training program and workshop each semester on safety for graduate and undergraduate students, faculty and staff which was first conducted in December 2005.
- Established a laboratory safety audit by industry by asking industrial visitors to our research laboratories to inspect a selected laboratory for safety and provide us with their written comments and feedbacks.

RESEARCH & SCHOLARLY ACTIVITIES

GRANTS and GIFTS

Missouri S&T - Research

- **(PI)** Experimental and computational investigations of plenum-to-plenum heat transfer under natural circulation in a prismatic very high temperature reactor, (Co-PIs: Rizwanudin - University of Illinois, Urbana-Champion, Usman – Missouri S&T, Co-Is: Jain - ORNL, Southworth – Areva, Woods – Oregon State University), NEUP – DOE, **US$799,999 (February 2014 – February 2017)**
- **(Co-PI) "**Computational Fluid Dynamics (CFD) Model Verification and Validation Using Advanced Non-Invasive Visualization Technique for Scaled-Down Core of Westinghouse SMR", SMR Consortium **(PI-Joseph Smith), US$74,071 (for year one – January, 2014-2015)**
- **(PI)** Identification of the type and thickness of deposits on crude oil transportation pipes, Shell, Houston, **US$29,900 (March 2013-February 2014)**
- **(PI)** Modeling of Adaptive ARC ce25 Plasma based biomass gasifier, Adaptive ARC, **US$75,000 (May 1, 2012 for one year)**
- **(PI)** Performance evaluation of Mina on-stream catalyst replacement (OCR) reactor through cold flow modeling and sophisticated techniques, Kuwait Institute for Scientific Research (KISR), Kuwait, **US$899,748, (In the final signing process, November 2012 – December 2014)**
- **(PI)** US State Department fellowship through CRDF, CRDF, **$14,000 (June-December, 2012)**
- **(PI)** Advancing microalgae culturing for efficient bioenergy production via dynamic growth, mass transfer and bubble dynamics investigations, Energy Research and Development Center – Missouri S&T, **$11,100, 2011/2012**
- **(PI)** US State Department fellowship through CRDF, CRDF, **$14,333, (April 1 to October 31, 2011)**
- **(Co-PI)** Infrastructure Upgrade of Radiation Measurement and Spectroscopy Laboratory at Missouri S&T, DOE-NEUP, PI: H. K. Lee, Co-PIs: S. Usman, X. Liu, M. Al-Dahhan (15%), **$300,000, September 1, 2012 to August 3, 2013**
- **(Co-PI)** Upgrade of Missouri S&T reactor for distance learning, PI: A. Alajo; Co-PIs: A. Kumar, M. Al-Dahhan, P. Whitefield, DOE-NEUP, **US$200,000 (plus University match of $114,260) (December 7, 2011 to December 7, 2012**
- **(Co-PI)** Upgrade the cooling system of S&T nuclear reactor, PI: A. Kumar; Co-PIs, Muthanna Al-Dahhan, Phil Whitefield, W. Huebner, M. O'Keefe, DOE-NEUP, **US$200,000 (University match of ~$50,000) (August 2010 - August 2011)**
- **(Co-PI)** Nuclear infrastructure upgrade to enhance research and teaching capabilities at Missouri S&T, PI: G. Mueller; Co-PIs: H. K. Lee, A. Kumar, S. Usman, C. H. Castano, M. H. Al-Dahhan, DOE-Nuclear Energy University Program (NEUP), **US$ 300,000 (plus US$50,000 cost sharing) (August 31, 2010 - August 30, 2011)**
- **(Co-PI)** Creation of a radiochemistry teaching program in nuclear engineering at Missouri S&T, PI: C. H. Castano, Co-PIs: H. K. Lee, U. Usman, M. H. Al-Dahhan, Nuclear Regulatory Commission (NRC), Curriculum Development Grant, **US$ 125,000 (July 1, 2010 - June 30, 2011)**

- **(PI)** Identification of various regime transitions in gas-liquid-(solid) bubble columns based on chaos and statistical analyses of radioactive particle tracking, gamma ray computed tomography, gamma ray densitometry, optical probe and differential pressure data, (Duration 36 months) (PIs: Al-Dahhan - USA (for the first 24 months), Schumpe, Germany – Technical University Braunschweig (for the last 12 months), Highly competitive grant from European Commission – Research Directorate-General, **Euro 362,201.03 (~US$ 507,081.44) (November 1, 2009 – October 31, 2012). Missouri S&T Share ~ Euro 201,736 (~US$ 282,430).**
- **(Co-PI)** Gamma Ray Computed Tomography for multiphase flow systems, Saudi Arabia, KAST (Initiation of long term collaborative research, PIs: Al-Johani and Shahata-Saudi Arabia, Al-Dahhan – USA), Nuclear Engineering Department, King Abdul Aziz University, Jeddah, **~ US$ 533,333 (September 2009 – August 2012)**
- **(PI)** Advanced high temperature gas nuclear reactor (HTGR) consortium and research program (Pebble bed reactors) (PI-for the subcontract) in collaboration with University of Missouri – Columbia (Professors Loyalka (PI for the grant) and Gosh), and North Carolina State University (professor R. Gardner), DOE-NERI, **total of US $ close to $ 3 million, my share is close to $ 900,000 (September 30, 2007 – September 29, 2011).**
- **(PI)** Advancing the fundamental understanding and scale up of TRISO fuel gas-solid spouted bed coaters via advanced measurement and Computational Techniques, PI: M. H. Al-Dahhan, DOE-NERI, **US$ 599,999.00 (September 1, 2007 – August 31, 2010)**

Missouri S&T - Education

- "State-of-the-art process control system for undergraduate unit operations laboratories including DeltaV industrial process control software", Emerson Process management, **(Al-Dahhan and Sitton), US$232,371 (discounted value), (2013-1014)**
- "MiMiC simulation Software" to be integrated with Emerson DeltaV for virtual experiments of undergraduate unit operations experiments and their process control, MYNAH Technologies, **(Al-Dahhan and Sitton), US$1,500,000 (2013)**
- "Gas Absorption Experiment for undergraduate unit operations laboratory", ConocoPhillips and its selected alumni, **(Sitton and Al-Dahhan), US$65,000 (including US$25,000 cost sharing from Provost) (2012-2014)**

Washington University in St. Louis as Principal Investigator (PI)

- Clean Alternative Energy using Slurry Bubble Column Reactors Consortium & Research Program funded by (ConocoPhillips (USA), Eni (Italy), Johnson Matthey Catalyst (UK), Sasol (South Africa), Statoil (Norway), **(September 1, 2006 – December 31, 2011), ($375,000 total, my share is $275,000).** Director and PI of the consortium in collaboration with Ohio state University (Professor L.S. Fan (member of National Academy of Engineering – Co-PI) and Rensselaer Polytechnic Institute (Professors S. Antal and R. Lahey (a member of National Academy of Engineering – Co-PIs).
- Hydrodynamics of Fluidized Reactors, Ineos Nitriles, **$45,000 (January 1, 2006 – December 31, 2006).**
- High Pressure Gas and Liquid Flow Distribution in a Trickle Bed Reactor, Total, France, **$100,000 (January 1, 2006 – December 31, 2007).**
- Improved Biomass Utilization in Digester through Remote Flow Sensing, DOE/Energy Efficiency Science Initiative, ~ **$2,098,687 (my share is about $1.3 millions) (July 1, 2001 – March 31, 2007)** with collaboration of Oak Ridge National Laboratory and Iowa Energy Center.
- Director of the High Pressure Slurry Bubble Column Research Consortium on Technological Advancement of High Pressure Slurry Bubble Column Reactor for Fischer-Tropsch Synthesis; three year extension funded by ConocoPhillips (USA), Eni Technology (Italy), Sasol (South Africa) and Statoil (Norway), **($ 1 million total) (my share is $700,000), (April 1, 2003 – December 31, 2007)**, with collaboration of Ohio State University Professor L.S. Fan, member of National Academy of Engineering) and Rensselaer Polytechnic Institute (RPI) (professor Steve Antal and Professor R.

Lahey, member of National Academy of Engineering) (**$50,000** per year for these universities). This work has been continuously supported by industry since I formed the consortium in 1999.

- High Pressure Slurry Bubble Column Consortium (formed and directed by me) to advance the knowledge and modeling of FT slurry bubble column reactors supported by Air Products and Chemicals (USA), Conoco (USA), Statoil (Norway) and Sasol (South Africa); Total funding in amount of **($600,000 total), (my share is $450,000)** for 3 years **(April 1, 1999 – March 31, 2003)** with collaboration of Ohio State University (Professor L.S. Fan, member of National Academy of Engineering) ($50,000 per year for Ohio State University).
- Flow Visualization of Polyethylene Gas-Solid Fluidization System, University of Twente, The Netherlands, **$45,000 (March 1, 2007 – March 31, 2008)**
- Fischer-Tropsch (FT) Reactor Modeling and Analysis, Syntroleum, USA, **$100,000 (April, 2005 – March 2007)**
- Assessing a bubble cap distributor design for its flow distribution via CT, ChevronTexaco, **$20,000 (September 1, 2004 – December 31, 2005).**
- Study of Bubble Column Reactor Operated in Bubbly Flow Regime for Hydro-conversion of Heavy Oils and Petroleum Feedstock, Snamprogetti, Italy, **$164,753 (March 1, 2002 – December 31, 2004).**
- Liquid Maldistribution in Trickle Bed Reactors and Performance of various distributor designs: Experimentation and CFD Modeling Study, Total, France, **$67,298 (August 8, 2002 – December 31, 2005).**
- Performance and Characterization of Structured Packed Bed, Bayer, **$125,000 (July 1, 2001 – June 30, 2004).**
- Flow Mapping of Gas-Solid Riser, DOE, Albuquerque Office – Sandia National Laboratory, **$225,000 (April 1, 2002 – March 31, 2005)** with collaboration of Sandia National Laboratory.
- Advanced Diagnostics Techniques for Three-Phase Slurry Bubble Column Reactors.
  DOE: **$380,095 total** for 3 years **(July 1, 1999 – June 30, 2003).**
  Air Products: **$150,000 total** for 3 years **(July 1, 1999 – June 30, 2003)** as a cost sharing.
  Total cost: **~ $543,371** for 3 years.
- Phase Distribution in Two-Phase Countercurrent Flow Packed Beds with Structured Packing, ABB Lummus Global, **$55,000 (1/1/2000 – 1/1/2002).**
- Flow Distribution in Laboratory and Pilot Plant Fixed Beds of Structured Packing Catalytic System, Air Products and Chemicals**, $70,000 (4/15/2000 – 10/14/2001).**
- Hydrodynamics and Mixing of Liquid-Solid Fluidized Reactor, ABB Lummus Global, **$155,000 (10/1/2000 – 6/30/2002).**
- Gas-Solid Riser Studies, DuPont, **$89,140 (6/8/2000 – 5/7/2001).**
- **$12,000** from DuPont to support the research of an undergraduate student (Boon Tee Ong) from National University of Singapore working with me on mass transfer in trickle bed reactors from **September 1 to December 31, 1999.**
- Hydrodynamics study of Ebullated beds, **$70,000.00**, UOP, **(January 1, 1998 – May 31, 1999).**
- Exxon Engineering Foundation Grant in Support of Research on Kinetics and Reactor Analysis for Improved Petroleum Refining/Hydroprocessing, Exxon Education Foundation, **$10,000 (1995/1996)**, **$10,000 (1996/1997)**, **$5,000 (1997/1999)**
- Particle motion in an ebullated bed, **$30,000.00,** Chevron, **(1997/1998).**
- Hydrodynamics and Mixing in Counter-Current Staged Bubble Column, **$60,000.00,** DuPont, **(1996/1997).**
- Evaluation of Liquid-Solid Mass Transfer in High Pressure Trickle-Bed Reactors, **$1000.00**, Engelmann Scholar Research Program-NSF Young Scholar Program Mentor, **(summer, 1995).**
- Scale-up and Design of High Volumetric Productivity and High Selectivity Reactor for Production of Amino Alcohol, **$55,440.00**, Monsanto, **(1996).**
- Periodic Operation of Trickle-Bed Reactors, **$17,000.00**, Exxon Research and Engineering Company, **(1994).**

Note: From 2002 to 2008 I established cooperation with ANSYS through which we received a 10 seat floating license of the latest versions of CFX (CFD code) for research purposes at **no charge** with technical support. We also get one free training credit for CFX codes each year and a training credit with Fluent. We have been exploring jointly the validation of CFD in simulating the hydrodynamics of multiphase reactors and bioreactors/anaerobic digesters.

Washington University in St. Louis as Co-Principal Investigator (Co-PI)

- Co-Leader in NSF Engineering Research Center – Center for Environmentally Beneficial Catalysis (CEBC) – Washington University as Core-Partner (Professor M.P. Dudukovic, Co-PI and Co-Leader) (for Washington University **~$350,000**/year 1; **~$420,000**/year 2; **~$460,000**/year 3; **~$520,000**/year 4; **~$560,000**/year 5) with University of Kansas (Head Quarters – Professor Bala Subramanian – PI), and University of Iowa and Prairie view A&M University as Core-Partners **(September 2003- August 2008).**
- Hydrodynamics of bubble column with and without internals for clean energy production, ExxonMobil, **$ 140,000 (January 2006 – June 2007).**
- Engineering Development of Slurry Bubble Column Reactor Technology, DOE via Air Products (DOE-FC22-95PC95051) – Extension of the ongoing research for two more years, **$354,000** ***(10/1/2000 – 3/31/2002)*** (PI-M.P. Dudukovic).
- Hydrodynamics of gas-solid riser, **$25,000**, Chevron, **(March 1999 - March 2000)**, (PI-M.P. Dudukovic).
- Multiphase velocity measurements in a gas-solid riser via CARPT, **$75,000**, Sandia National - Laboratory, **(June 1, 1999 – September 30, 1999)**, (PI-M.P. Dudukovic).
- Liquid-Solid Recirculating Bed, **$60,000**, UOP, **(1997)**, (PI-M.P. Dudukovic).
- Liquid-Solid Recirculating Bed, **$93,775.00**, UOP, **(1995/1996)**, (PI-M. P. Dudukovic').

Washington University in St. Louis Co-Investigator

- Novel Techniques for Slurry Bubble Column Hydrodynamics, **~$650,000,** Funded by DOE. The project is a joint research between Washington University (M.P. Dudukovic', PI) Ohio State University (L.S. Fan, Co-PI) and Exxon Research & Engineering Company (M. Chang, Co-Investigator) **(July 1995 - June 1998).**
- Engineering Development of Slurry Bubble Column Reactor (SBCR) Technology, **~$1,450,000,** Funded by DOE via Air Products and Chemical, Washington University (M.P. Dudukovic', PI) as a subcontractor **(April 1, 1995 – March 31, 2000).**

1995-2008 Industrial Consortium at Washington University - Chemical Reaction Engineering Laboratory

I was instrumental as a Co-Director in expanding the industrial sponsorships since 1995 to 2008 (Director: Professor M. P. Dudukovic). Each member company sponsors the consortium on unrestricted research in the amount of **$20,000 per year (the total ~ $300,000 to $400,000 per year) as Co-PI (on paper), but the fact I was handling all things in the role of PI**. The CREL Industrial sponsors as of 2006 to 2008 were: ADM, BP, Chevron, ConocoPhillips, DuPont, Eastman Chemicals, Eni (Italy), ExxonMobil, Johnson Matthey (UK), Sasol (South Africa), Shell, Statoil (Norway), Total (France) and UOP **(total of $3 million to $4 million from 1995 to 2008)**.

Externally Funded Fellowships/Scholarships under My Supervision

Missouri S&T

- Fellowships sponsored by US Department of State to support Dr. Saba Gheni (University of Tikrit – Iraq) and Dr. Amer Daham Zmat (University of Al-Qadysia) for 6 months (June-December 2012).
- Fellowship from Ministry of Higher Education of Iraq – University of Al-Nahrain for supporting the sabbatical of Dr. Yasser for one year (January– December, 2012).

- Fellowship from Technical University of Dresden, Germany to support Christine Meitzner to complete here MS equivalent thesis at Missouri S&T (May - November, 2011).
- Fellowships sponsored by US Department of State to support Dr. Ahlam Abdulghani, Mr. Yassif Mohammed and Mr. Hayder Hassan for 6 months (April-October, 2011).
- Fellowship from Ministry of Higher Education of Iraq – University of Technology for supporting the sabbatical of Dr. Ghanim Maqbool Alwan for 6 months (January – June, 2011).
- Fellowship from China Petroleum University for supporting the sabbatical of Dr. X. Lan for one year (February 1, 2010 – January 31, 2011).
- Fellowship from European Commission for the support of Dr. Stoyan Nedeltchev for three years (two years on research at my labs and one year in Germany) (February 2010 – February 2013).
- Scholarship from HCED and Ministry of Higher Education of Iraq for the support of PhD students (Abbas Sultan started in Spring 2013, Laith Sabri started in Fall 2013) and MS student (Ali Toukan started in Fall 2013).
- Scholarship from Ministry of Higher Education of Libya for the support of PhD students (Faraj Zaid, started in Spring 2009, Abdelsalam Efhaima, started in Fall 2011).
- Scholarship from Ministry of Higher Education of Saudi Arabia for the support of PhD students (Mohamed Al-Mesfer, started in Fall, 2009 and graduated in May 2013, Nasser Zouil started Fall 2013).
- Scholarship from Malaysia government for the support of PhD students at S&T chemical and biological engineering and nuclear engineering departments (Abdul Rahman Fitri, started in fall 2009, Khairul Anwar, Nuclear engineering, started in spring 2011).

Washington University in St. Louis

- ~ $24,000 Fellowship from Beijing Chemical Technology University (Yuan Zhou) (September 2008 – August 2009) to complete her doctoral thesis with me as co-advisor on multiphase monolithic reactor hydrodynamics
- ~ $15,000 Fellowship from Ministry of Higher Education of Iraq (From December 2007 – April 2008) to support a graduate student (Rahman Abdulmohsin) to complete his PhD research on heat transfer study in bubble column.
- ~ $ 50,000 per year since 2001 – April 2009 from Total, France to support a fellowship (N. Dromard, Delsart Olivier, M. Capitaine, Arnaud Denecheau) on hydrodynamics investigation of trickle bed reactors for clean fuel production.
- ~ $24,000 (September 2007-September 2008), a fellowship from University of Sao Paulo, Brazil to support a graduate (Pablo Selvador) student to complete his PhD thesis with me as co-advisor on gamma ray tomography for multiphase flow systems.
- ~ $12,000 (March 2006 – September 2006) a fellowship from University of Pretoria to support a graduate student (W. v.d. Merwe) to complete his PhD thesis on the effect of catalyst wetting on trickle beds performance.
- ~ $12,000 (March 2006-September 2006) a fellowship from university of Curtin, Australia to support to support a graduate student (M. Akbar) to complete his PhD research on bubble dynamics and CFD in bubble columns.
- ~ $ 12,000 (September 2004 – March 2005) a fellowship from Almeria university to support a graduate student (Elisa Rodrigues) to complete her PhD on bubble dynamics in fungi cultures.
- ~ $ 45,000 (2003-2004) a fellowship from Sasol, South Africa (Holland Office) to support a graduate student (K. Koop) to complete his M.S. degree on high gas velocity bubble columns.
- ~ $ 26,000 per year (2002-1004) from Dresden University to support graduate students (A. Vold, T. Bauer, R. Guettel) to complete their M.S. thesis on structured packed bed reactors.
- ~ 12,000 from DuPont Fellowship (Sept. 1999 – Jan. 15, 2000), Boon-Tee Ong from National University of Singapore to do a research project under my supervision. The work resulted in a publication.

- Postdoctoral fellowship from DuPont, Dr. Jacques F. Nicole, Swiss Federal Institute of Technology, Switzerland, $89,140.00, May 2000 to June 2001, Gas-solid system (riser) catalyst development and multiphase reactor modeling.

Equipment Received as Gift

Missouri S&T

- Industrial scale pilot plant (18-inch diameter) bubble/slurry bubble column facility at S&T from ConocoPhillips, **~$600,000 (2009).**
- High temperature and high pressure bench scale process of 1 liter autoclave reactor at S&T from ConocoPhillips, **~$400,000 (2009).**
- High temperature and high pressure 1 liter autoclave reactor unit at S&T from ConocoPhillips, **~$50,000 (2009).**
- Mass spectrometer and GC at S&T from ConocoPhillips, **~$50,000 (2009).**
- Electrical Capacitance Tomography from DuPont at S&T, ~ **US $ 90,000 (2008).**

Washington University

- GC from Monsanto, **~ $10,000 (2002).**
- Hot gas-solid riser facility from DuPont, **~ $50,000 (2001/2002).**
- Laboratory scale of structured packing/monolith beds facility for hydrodynamics and mass transfer studies. This set-up will be as well used for undergraduate experiment, **~$15,000**, **(2002).**
- Glass-packed bed distillation column donated by Tosco Refinery (formerly Wood River Refinery) for undergraduate experiment, **~$15,000**, **(2000).**
- **~ $10,000** worth of bioreactors from University of Almeria University – Spain as a part of the collaboration on advancing the modeling, design and scale up of multiphase bioreactors, **(1999).**
- **~ $11,000** compressor donated by Exxon Chemical to trickle bed reactors facility, ***(1999).***
- **~ $30,000** glass gas-solid riser donated by DuPont to be used for graduate research and for undergraduate experiments, **(1999).**
- Using Advanced Instruments (Fluke 702) by Students in Teaching/Research Chemical Engineering Laboratories, **$4,887.00**, Fluke Corporation, **(1995).**

RESEARCH FACILITIES DEVELOPED

Many advanced research measurement techniques and facilities have been designed, developed and implemented under my supervision.

Techniques and Facilities Developed and Implemented at Missouri S&T

The following selected techniques and facilities have been developed at Missouri S&T which make my research labs unique and state-of-the-art.

- New generation of two radioactive single particle tracking techniques (RPT). Each technique provides in a non-invasive manner the 3D flow field, velocity, turbulent parameters, and local and global residence times distribution and many other parameters.
- Novel multi-radioactive particle tracking (M-RPT) technique to track up to 8 particles simultaneously that each can represent different phase or different group of solids which was developed in collaboration with Oak Ridge National Laboratory. The technique provide in a non-invasive manner for each particle the 3D flow field, velocity, turbulent parameters, and local and global residence times distribution and many other parameters.
- Advanced, accurate and fully automated in three direction movement calibration device for radioactive particle tracking techniques (RPT and M-RPT) that is suitable for airlift bioreactor and anaerobic digesters besides other reactors types equipped with internals.

- Novel hybrid calibration technique that will advance RPT and M-RPT to be applied on industrial units.
- Novel Gamma ray dual source/energy computed tomography (DSCT) technique which was developed in collaboration with Oak Ridge National Laboratory and a novel image reconstruction algorithm which was developed in collaboration with electrical engineering department for the measurement in a non-invasive manner of the cross sectional time averaged phase distribution along the height of a multiphase flow system of three phases dynamically moving.
- Single source gamma ray computed tomography technique for the measurement of the time averaged cross sectional distribution of phases for two phase flow systems and or for two phase flow packed beds.
- Sophisticated gamma ray densitometry for flow regime and flow pattern identification and for reduced gamma ray tomography.
- Single point optical probe techniques for measurement of gas and liquid velocities and holdup in monolith and structured beds and for measurement of volume bed expansion in a mixture of solvent and supercritical CO_2 for the development of environmentally benign processes and the phase transition from subcritical to supercritical state.
- 4-point optical probe techniques (quartz and plastic) and their manufacturing facilities for bubble dynamics measurements in gas-liquid and gas-liquid-solid systems (it measures bubble size, bubble velocities in all direction, gas-liquid specific interfacial area, local gas holdup, bubble frequency, bubble direction distribution, local gas holdup, etc.).
- Optical probes for gas-solid systems that can measure simultaneously solids and gas holdups and velocities and their fluctuations.
- Novel and advanced heat transfer rate and coefficients measurement techniques; Probes for local point measurements, probes that simulate and mimic the heat exchanging tubes and internals placed inside the reactors, and probes that mimic the pebbles. These probes can fully scan the 3D heat transfer rate and coefficients distribution inside the systems of interest.
- Mass transfer rate and coefficient measurement techniques; Point measurement based on optical probe and overall measurement based on continuously measured tracer signal of partially dissolved gas.
- A methodology that combine optical probes for bubble dynamics and mass transfer measurement to measure the mass transfer rate and coefficient of gases that are hard to measure in systems of interest.
- Gas phase RTD, dispersion and mixing intensity measurement based on continuously measured tracer signal of the injected gas with negligible solubility in the liquid phase
- Flow regime identification technique for multiphase flow systems in a non-invasive manner based on nuclear gauge densitometry
- Pressure transducers
- 6 inch and 18 inch diameter bubble and slurry bubble columns and gas-liquid-solid fluidized beds setups that are equipped with and without internals
- Industrial 24 inch diameter bubble and slurry bubble columns and gas-liquid-solid fluidized bed setups that are equipped with and without industrial heat exchanging internals
- 6 inch and 18 inch diameter gas-solid fluidized beds setups
- 6 inch and 1 ft. multiphase packed bed setups
- 2 inch monolith setup
- Two 1 liter autoclave reactors
- High temperature and high pressure pilot plant process that is equipped with various ranges of mass flow-meters for gas and liquid phases and for temperature and pressure monitoring.
- Air Lift and bubble column Bioreactors and Photo-bioreactors set-ups: air-lift split bioreactor and tubular bioreactor.
- Pilot Plant scale (18 inch diameter) gas-solid Fluidized bed set-up.

Computing Techniques, Modeling and Data Processing Developed and Implemented at Missouri S&T

The following selected computing techniques, modeling and data processing that have been developed and utilized at Missouri S&T which complement the unique and state-of-the-art research labs.

- Computational fluid dynamics (CFD) for various multiphase systems, Discrete Element Method (DEM) for solids dynamics and combination of CFD-DEM for flowing fluids and solids dynamics
- Mechanistic and non-ideal/non-linear reactor scale models for various multiphase reactors and flow systems
- Chaotic and statistical analyses to time series signals obtained from various sophisticated measurement technique which enable understand the phase's behaviors and what is going on inside the opaque flow systems.
- Artificial neural network and mechanistic correlations that facilitate new methodologies for design and scale up of multiphase reactors and flow systems.

Facilities Developed and Implemented at Washington University in St. Louis

- 6-inch high pressure (up to 200 psi) and high gas velocity (up to 60 cm/s at high pressure) bubble/slurry bubble column reactor (SBCR) research facilities. These facilities consist of two set-ups:
    - SBCR for computed tomography (CT) and computer automated radioactive particle tracking (RPT)
    - SBCR with windows and ports along the column height for dynamic pressure transducers, optical and conductivity probes, visualization techniques, etc.
- Gas-solid riser facility (6 inch diameter and 26 ft. height). It can be used as gas-solid fluidized bed and circulating bed.
- 1 ft. diameter two phase flow packed bed reactor facility that can be operated co-current and counter-current modes of operation.
- Pilot plant scale column (18 inch in diameter and 13 ft. height). The unit can be operated as continuous, semi-continuous and batch gas-liquid system, slurry bed, gas-liquid-solid fluidized bed (ebullated bed), liquid-solid fluidized bed and gas-solid fluidized bed. The reactor is equipped with dynamic differential pressure transducers and conductivity probe tracer technique along its height. The unit can be as well utilized as a bioreactor for bioprocessing and biological waste treatment studies.
- Trayed bubble column facility (8 inch diameter and 9 ft. height). The unit can be as well operated as a bioreactor.
- 8-inch and 18-inch columns with internals to investigate the effect of heat exchanging internals on the hydrodynamics and transports of bubble slurry bubble columns.
- Atmospheric structured packed bed reactor facilities. Both 1 ft. diameter and 2 inch diameter structured packed bed facilities that can handle different type of structured beds (i.e. monolith, static mixer configuration, etc.) in co-current and countercurrent modes of operation. These facilities are used for reaction performance (2 inch reactor), mass transfer and hydrodynamic studies. They can be as well operated as bioreactors for various bioprocessing.
- High pressure packed bed reactors facility, which has been used for reaction performance, transport and hydrodynamic studies. Currently, the facility is expanded to be used for wastewater treatment via wet catalytic oxidation.
- High pressure 6-inch packed bed facility for hydrodynamics and transports studies. The unit can measure simultaneously the exit flux distribution of liquid and gas phases.
- Measurement techniques and their data acquisition system such as dynamic differential pressure transducers, tracer technique via conductive probe measurements and optical probes.
- Up-to-date PCs and workstation for computation, data processing and measurement techniques.
- Electro-chemical method for liquid-solid mass transfer coefficient and liquid velocity measurements.
- Development of Combined bore-scope and optical probes to film and characterize bubbles dynamics in stirred tank reactors.
- Development a mini-autoclave (25 ml) reactor system and mini-tubular reactors.

- Development of 300 ml autoclave reactor equipped with IR measurement techniques.
- Two pilot plant scale anaerobic digesters of 96 Liter in capacity (18 inch diameter) set-ups; one for performance study and another for RPT, M-RPT and CT measurements.
- A number of various configurations and modes of mixing (mechanical agitation, gas circulation, slurry circulation, liquid circulation, no mixing) of laboratory scale anaerobic digesters for diary waste treatment and biogas production with all the related measurement and analytical equipment.
- Development of bioenergy production (bioethanol) and bioreactor system facilities.
- High pressure and high temperature 2 inch diameter pilot plant scale packed bed reactors (structured and non-structured beds) that are enclosed in a steel box and monitored via video camera which has been approved for safe operation.

AWARDS AND RECOGNITIONS

Awards

- Saudi Society of Chemical Engineers Shield for contribution to chemical engineering in the field of alternative and renewable energy, Saudi Arabia, Riyadh, May 18, 2011.
- "2010 make a difference in STEM Award". STEM: Science, technology, engineering and mathematics. It was received during the joint celebration of National Engineers week attended by Missouri S&T, the Society of American Military Engineers and Fort Leonard Wood members and Friends.
- Mesopotamia Award – Washington D.C., March 14, 2009, for outstanding achievements in Engineering in US achieved by an academician from Iraq origin, Iraqi Cultural Attaché, administered by the US National Academies – Washington D.C.
- CLRI Dr. Y. Nayudamma Distinguished Award 2008 for outstanding achievements in Chemical Engineering given by Indian Institute of Chemical Engineers during its annual meeting, ChemCon-2008, December 27-30, 2008 and during US-India Symposium on energy and sustainable development.
- Distinguished Service Award, Students and teachers as research scientists, University of Missouri – St. Louis, in grateful recognition of outstanding support and commitment to the enhancement of science education, July 18, 2008.
- UDCT Golden Jubilee Visiting Fellowship, UDCT – India, for the year 2005-2006.
- 2004/2005 Mentor of the year "Big Fish" Award, elected by graduate students, Association of Graduate Engineering Students (AGES)
- STARS award for 5 years of service award – NSF Research Mentor Programs, July 2002.
- Appreciations and shields for contributions to Higher Education and scientific research in Iraq: University of Kufa (December, 2010); University of Tikrit for lecturing by video conference to faculty members and graduate and undergraduate students (May 2010); Ministry of higher education (December 2009); University of Karbala (December 2009); University of Al-Qadysia (June 2009); Ministry of Science and Technology (June, 2009)
- Higher Ministry Education Award for the first graduate in the Chemical Engineering Department, Baghdad, (1979) and among the top five out of more than1000 graduated students in College of Engineering.
- University president Award for the first graduate in the Chemical Engineering Department, Baghdad, (1979) (out of 136 students) and among the top five out of more than 1000 graduated students in College of Engineering.
- University of Baghdad Academic Excellence Award for the first graduate in the Chemical Engineering Department, (1979).
- Society of Engineers Award (Baghdad) for the first graduate in the Chemical Engineering Department, (1979).
- Chemical Society Award (Baghdad) for the first graduate in the Chemical Engineering Department, (1979).

Recognitions

- Invited by the "*Catalysis Review"* to provide an overview of the role of catalytic multiphase reactors in "green" chemical manufacturing, Spring 2014.
- Dow Chemicals adopted my development of liquid-liquid contactor for mass transfer and reaction studies to be used in their new chemical processes development which has been introduced as Al-Dahhan Cell
- Selected by IAEA (International Atomic Energy Agency) and KISR (Kuwait Institute for Scientific Research) on expert mission to Kuwait to help KISR implementing radioisotopes for enhanced petroleum processing, 2012.
- Selected by UN-UNESCO be expert in participating in the effort for "Rebuilding Iraqi Higher Education System" particularly establishing quality assurance of engineering education from June 2011 to December 2014. Participated in delivering workshop in Doha-Qatar, June 2011, in Erbil – Kurdistan Iraq, June 2012 and February 2014, Amman, Jordan, October 2013 (two workshops).
- Recognized by University of Technology, Iraq-Baghdad -Shield of the University, December 2013.
- Selected by Rentech (alternative energy company) to be their consultant to assess the risks and benefits of their scale up design from demonstrating unit to commercial plant, 2012.
- Selected by UN-UNESCO to be a member of the team for a workshop held in Beirut-Lebanon, October 2011 for "Rebuilding the Scientific Research in Iraq"
- Selected by Kuwait Institute for Scientific Research (KISR) to be their consultant for reviewing and implementing their strategic plan for Petroleum Research and Studies Center; 2010/2011
- Letter of acknowledgement for high score of student evaluation for the course ChE383 (as a department chairman I teach one course a semester)
- Mentioned in 2011 US-Iraqi Physician Forum, Detroit, Michigan, May 28, 2011 as one of the fewer Iraqis in USA with the most significant technical achievement
- Inducted to Tau Beta Pi as a member in April 2011. It is the US honor society for engineers.
- Selected to be external examiner to PhD theses by universities around the world (e.g., Canada, Mexico, Europe, Asia, Africa)
- Selected as a representative of IAEA (International Atomic Energy agency) to Asia Scientific short course in Malaysia in August 2010 on industrial gamma ray process tomography and selected to teach the short course. Scientists and Engineers from 12 Asian countries were attended.
- Selected to be among 15 Professors from US to participate and give talks in US-India Symposium on development of sustainable energy and Environment sponsored by NSF in December 2010
- Selected to be a technical consultant on a new ADM process related to processing the byproduct from biodiesel production
- Selected by Catalyst Group as a consultant in 2010 to write two chapters on scale up of trickle bed reactors and fluidized bed reactors to industrial sponsors
- Selected by Iraqi ministries of Higher Education, scientific research, industry, and oil and mineral among few scientists and academicians invited from the western world to help them developing scientific and engineering research and higher education policies and capacities, Baghdad, June 22-24, 2009.
- Selected as a panelist on clean coal utilization session as a part of Energy Summit organized by University of Missouri System – Columbia, April 22-23, 2009.
- Selected by International Atomic Energy Agency (IAEA) to Korea – Daejeon (Korea Atomic Energy Research Institute, KAERI) for one week (July 6 – 10, 2009) to give short course to engineers, scientists, faculty, and graduate students on industrial applications of radioisotopes for imaging and visualization.
- Selected as a panelist in Iraqi Academics Conference (March 14-15, 2009) by Iraqi Cultural Attaché administered by the US National Academies – Washington D.C. on "How can we help Iraqi academia".
- Selected by UiTM University in Malaysia – Shah Alam, to review their chemical engineering curriculum and program and of affiliated appointment, February, 2009.

- Selected, invited and sponsored by US – India Symposium on energy and sustainable development sponsored by NSF to give an invited talk in the symposium, December 27-29, 2008, Punjab University.
- Selected to chair the consultants meeting called by International Atomic Energy Agency (IAEA) to assist the agency in formulating an international project on visualizing industrial multiphase flow systems using radioisotopes, October, 2008, Vienna, Austria.
- Featured by St. Louis Magazine - October 2008 Issue, page 61 - 68 – on "The Alternative to Alternative Energy" – as one of three St. Louis researchers who are looking for alternative energy sources.
- Featured by 81 leading media, news and press agencies worldwide about the recent achievements on treating animal and farm wastes to generate bioenergy.
- Selected in May 2008 by International Atomic Energy Agency (IAEA) for two weeks to Malaysia – Malaysian Nuclear Agency to train about 30 engineers, scientists, faculty, and graduate students on industrial applications of radioisotopes for imaging and visualization.
- Fellowship with full support to attend and present paper in cell culture engineering conference – Engineering Conferences International – Brisbane, Australia – April 14-18, 2008.
- Selected in 2007 as an expert to help developing with HOK the research laboratories of King Abdullah University for Science and Technology – KAUST for graduate studies, Jeddah, Saudi Arabia.
- Selected to chair the consultants meeting called by International Atomic Energy Agency (IAEA) to help the agency establishing an international project of radioactive particle tracking techniques, October 22-25, 2007, Vienna, Austria.
- Featured as the invited speaker to BTL (Biomass-to-Liquid-Fuels) 2006, Munich, Germany.
- Featured as the invited speaker on the website of the 2004 BIOPHEX Conference & Expo.- Reed Exhibition.
- Selected to receive travel awards to many national and international meetings as invited speaker (2001-present)
- Certificate of Appreciation from the National Science Foundation-Young Scholars Program (1995 to 2008).
- Exxon Education Foundation Research Grant (1995/1996, 1996/1997, 1997/1999).
- Certificate of achievement from The American Institute of Chemical Engineers, November (1992).
- Dean's list, 1977 - 1979, and Baghdad University's graduates honor list, (1979).
- Award to be trained in Yugoslavia, (1978).
- Ranked first out of 136 students graduated in the chemical engineering department, and among the top five of more than 1000 students graduated in nine different departments of the engineering school. Ranked first from first grade through engineering school.

RECOGNITIONS AND AWARDS RECEIVED BY STUDENTS UNDER MY SUPERVISION

- Vaibhav Khana (PhD Student, Missouri S&T) was featured by, Advanced Short-Term Research Opportunity (ASTRO), Oak Ridge Institute for Science and Education (ORAU), Oak Ridge National Lab (ORNL) for his achievement due to the quality of supervision and training he has been receiving at Missouri S&T.
- Vaibhav Khana (PhD student, Missouri S&T) was selected by Oak ridge National Lab to work on computing problem during Summer Semester of 2012 and Summer and Fall Semesters of 2013.
- Rahman Abdulmohsin (PhD student, Missouri S&T) received travel award to ISCRE 22 in Holland, September 2012.
- Vaibhav Khana (PhD student, Missouri S&T) received travel award to ANS conference in 2010
- Sean Mueller, PhD student whom I involved in mentoring him at Washington University, received Bridging GAPS Award for promoting interschool communication and collaboration at the university (2009)
- Ahmed Youssef (PhD student, Washington University) received Frist Prize in graduate students' research symposium, engineering category, Washington University in St. Louis, (2009)

- Mohamed Ezat Awad and Ahmed Youssef (PhD student, Washington University) won travel award from World Congress on Chemical Engineering, WCCE08, Montreal, Canada, August, 23-28, 2009
- Ahmed Youssef and Mohammed Ezat Awad (PhD student, Washington University) selected to be sponsored by Bioenergy-II: Fuels and Chemicals from Renewable Resources, March 8-13, 2009, Rio de Janeiro, Brazil.
- Ahmed Youssef and Mohammed Ezat Awad (PhD student, Washington University) selected to be sponsored by Gas-Liquid-Solids Reactors (GLS 9), Montreal, Canada, August, 23-28, 2009.
- Zachary Levinson, High school Student – in students and teachers as research scientists (STARS) - worked under my supervision in summer 2008 received the 2008 LMI/D3 Technologies Award for excellence in research for his research on heat transfer in bubble column for energy efficient clean fuels production.
- Mohamed Ezat Awad (PhD student, Washington University) awarded the Cheryl Walzel-Frick and F. Alan Frick scholar for 2007-2008
- Adam Rey, High school student worked under my supervision received in 2007 a "highly superior" rating from St. Louis Division of the Missouri Academy of Science on his work with my on bubbly dynamics characterization in bubble column using optical probe, March, 2007.
- Ahmed Youssef (PhD student, Washington University) Awarded the August and Ruth Momeyer Scholarship – Washington University in St. Louis, (2007).
- Ana Beatriz (Bia) Henriques, (PhD student, Washington University) received "Honorable Mention" in the ChE Division Poster Competition at the 2006 ASEE Meeting, Portland, Oregon, "A bioenergy-based bench-scale experiment for undergraduate engineering students", Session 1513.
- Bia Henriques (PhD student, Washington University) won the Engineering Conferences International (ECI) travel award to attend and participate in organizing Bioenergy I: from concept to commercial production, March 5-10, 2006.
- Todd Frederick Romkema, high school student – The Pfizer & Solutia STARS Program, won the 2005 Pfizer award for Excellence in Research.
- Mehul Vesvikar (PhD student, Washington University) won 2005 and 2006 outstanding laboratory teaching assistant, Chemical Engineering Department, Washington University.
- Sean Mueller (PhD Student, Washington University) won August and Ruth Homeyer Memorial Scholarship for graduate students (2005).
- Jing Guo (Doctoral student, Washington University) won ISCRE 18 travel award to attend ISCRE-18, Chicago, June 7-9, 2004
- Jing Guo (Doctoral student, Washington University) won 2004 outstanding laboratory teaching assistant, Chemical Engineering Department, Washington University.
- Rebecca Hoffman (M.S. student) won prize for her presentation in 9th annual Mid-America Environmental Engineering Conference – 2004. The award was given by the district 8 branch of the American Public works association.
- Huping Luo (Doctoral student) won the Chemical Reaction Engineering (CRE) Division travel award for 2003 AIChE meeting in San Francisco.
- Satish Bhusarapu (Doctoral student) won the Chemical Reaction Engineering (CRE) Division travel award for 2003 AIChE meeting in San Francisco.
- Mehul Vesvikar (D.Sc. student) won the International Engineering Conference travel award for the Computational Fluid Dynamics in Chemical Reaction Engineering III, Davos, Switzerland, May 25-30, 2003
- Rebecca Hoffman (M.S. student) Won 2nd place award in Poster Students presentation – Environmental Division, 2002 AIChE meeting, Indianapolis, Indiana, November 3-8, 2002.
- Javier Alvare (M.S. degree) won the travel award for 2001 AIChE meeting in Reno – Chemical Reaction Engineering Division.

- Robby Prasad, high school student – NSF-Solutia STAR Program, won the 2000 E. Reuben and Gladys Flora Grant Charitable Trust Award for Excellence in Research.
- Amy Chen (undergraduate student) qualified for honorable mention in the 2000 AIChE Regional Conference held in St. Louis, March 24-26, 2000.
- Y. Yiang (Doctoral student) won the department best graduate student seminar, (1999).
- Mathew Muether, high school student - NSF Young Scholar, won the 1998 E. Reuben and Gladys Flora Grant Charitable Award for excellence in research.
- Yi Jiang (Doctoral student) and Jonathan Mettes (undergraduate student) won 2nd place prize – Group 1: Fundamental Science and Engineering , 1998 AIChE annual meeting-Students Poster.

THESES SUPERVISED

Graduate Students

ADVISOR

Missouri S&T

PhD Students: ***1. Rahman Abdulmohsin*** (Graduated December 2013); ***2. Shreekanta Aradhya*** (Graduated May 2013); ***2. Faraj Zaid*** (Graduated May 2013); ***3. Moses Kagumba*** (Graduated May 2013); ***4. Vaibhav Khana*** (Graduated December 2013); ***5. Mohamed Al Mesfer*** (Graduated May 2013); ***6. Abdul Rahman Fitri*** (expected to graduate in Spring 2014); ***7. Neven Y. Ali*** (Nuclear Engineering, expected to graduate in Fall 2014); ***8. Khairul Anwar Mohd Salleh*** (Nuclear Engineering, expected to graduate in spring 2014); ***9. Abdelsalam Efhaima*** (expected to graduate in 2015); ***10. Aastha Ojha*** (expected to graduate in fall 2014); ***11.Thaar Aljuwaya*** (expected to graduate in fall 2015); ***12. Abbas Sultan*** (expected to graduate in 2016); ***13. Laith Sabri*** (expected to graduate in 2016); ***14. Vineet Alexander*** (expected to graduate in 2016); ***15. Ibrahim Said Ahmed*** (expected to graduate in 2017);

MS Students: ***1. Humyua Sharif*** **(**Graduated August 2010, academic advisor); ***2. Christine Meitzner*** (Graduated in December 2011, Technical University of Dresden, Germany); ***3. Fada Ahmed*** (Nuclear Engineering, expected to graduate in 2014); ***4. Vivek Rao*** (Graduated in summer 2012, academic advisor); ***5. Rasika Nimkar*** (Graduated in Fall 2012 – Project – Not thesis); ***6. Ali Toukan*** (expected to graduate in 2015); **7. Ahmed Jasim** (expected to graduate in 2015)

Washington University

Doctoral Students: ***1. Mohammed Ezat Awad*** (graduated in Spring 2012); ***2. Ahmed Youssef*** (graduated August 2010); ***3. Bia Henriques*** (graduated in August 2009); ***4. Rajneesh Varma*** (graduated in 2008); ***5. Wu Chengtian*** (graduated in 2007); ***6. Lu Han*** (graduated in 2007); ***7. Ashfaq Shaikh*** (graduated in 2006); ***8. Mehul Vesvikar*** (graduated in 2006); ***9. Shaibal Roy*** (graduated in 2005); ***10. Huping Luo (***graduated in 2005); ***11. Satish Bhusarapu*** (graduated in 2005); ***12. Jing Guo*** (graduated in 2005); ***13. Novice Rados*** (graduated in 2003); ***14. Yi Jiang*** (graduated in 2000)

MS students: ***1. Rebecca Hofmann*** (graduated in 2005); ***2. Eusebio Palmisano*** (graduated in 2004); ***3. Javier Alvare*** (graduated in 2002); ***4. Wes Highfill*** (graduated in 1998)

CO-ADVISOR – Washington University

Doctoral Students: ***1. Zeljko Kuzeljevic*** (graduated in 2010); ***2. Junli Xue*** (graduated in 2004); ***3. Boon-Cheng Ong*** (graduated in 2003); ***4. Puneet Gupta*** (graduated in 2001); ***5. Shantanu Roy*** (graduated in 2000); ***6. Mohan Khadilkar*** (graduated in 1998)

International Graduate Students Supervised as Co-Adviser and Worked in my Lab

PhD Students: ***1. Pablo V. Salvador (PhD, Brazil)*** (graduated in 2008, University of Sao Paulo (USP), Brazil); ***2. Rahman AbdulMohsen (PhD, Iraq)*** (graduated in 2008, University of Technology in Baghdad, Iraq); ***3. Tobias Bauer (PhD, Germany)*** (Master degree (graduated in 2003) and Doctoral degree (graduated in 2007), Technical University of Dresden, Germany); ***4. Ertugrul Ercok (PhD, Turkey)*** (graduated in 2007, Ataturk University, Turkey); ***5. Werner van der Merwe (PhD, South Africa)*** (graduated in 2007, University of Pretoria, South Africa); ***6. M. Arif (MS, Pakistan)*** (graduated in 2007, Pakistan Institute of Engineering & Applied Sciences (PIEAS), Islamabad, Pakistan); ***7. Muhammed Akbar (PhD, Australia)*** (graduated in 2006, Curtin University, Australia); ***8. R. Guettel*** **(MS degree, Germany)** (graduated in 2005, Technical University of Dresden, Germany); ***9. Elisa Rodrigues (PhD, Spain)*** (worked in 2004, Almeria University, Spain); ***10. Jana Huettmann (Diploma, Germany)*** (worked in 1997, Martin-Luther University, Germany)

Graduate Students I participated in Mentoring at Washington University during their work

PhD Students: ***1. Sean Mueller*** (graduated in August 2009); ***2. Nayak Subramanya*** (graduate in 2009); ***3. Debangshu Guha*** (Doctoral degree, 2007); ***4. Radmila Jevtic*** (graduated in 2008)

External Examiner for International Students for the work completed at Their Institutions

- Victer Veldman, MS, Liquid-solid mass transfer in conventional and inverse fluidized beds, University of Pretoria, South Africa, March 14, 2013.
- Moayed Youssef Al-Bassam, PhD, Use of advanced separation techniques in pollution control in petroleum industries, Alexandria University, Faculty of Engineering, Chemical Engineering, Alexandria, Egypt, October 2011
- Nabeel S. M. Abo-Ghander, PhD, Coupling dehydrogenation of ethyl benzene with hydrogenation of nitrobenzene in an auto thermal catalytic membrane reactor, The University of British Columbia, Chemical and Biological Engineering, Vancouver, Canada, November 2010
- Mohamed, H. M. Mowena, PhD, Study of mass transfer in agitated vessels, Alexandria University, Faculty of Engineering, Chemical Engineering, Alexandria, Egypt, October 2010
- Fabiana Mederos, PhD, Modeling of trickle bed reactors, Institute Mexico de Petroleum (IMP), June 17-18, 2010.
- Kamal Uddin Ahmed, PhD, Batch and column adsorption studies for simultaneous removal of iron, arsenic and fluoride by wooden charcoal and river sand used as filter media in indigenous household iron filter units or rural and semi-urban Assam (India), Department of Civil Engineering, IIT Guwahati – India, June 2010.
- Werner van der Merwe (M.S. degree), the morphology of trickle flow liquid holdup, University of Pretoria, South Africa, 2004.
- T. Renganathan, (Ph.D. degree), hydrodynamics and mixing characteristics of inverse fluidized bed, IIT Madras, India, 2002
- A. J. van Houwelingen (M.S. degree), the morphology of solid-liquid contacting efficiency in trickle-flow, University of Pretoria, South Africa, 2006.
- Ahmed Saad Shehata (Ph.D.), performance improvement of diffusion controlled chemical processes used for liquid-liquid extraction by using a set of rotating screen disks, Alexandria University, Egypt, 2007.
- Moustapha Ibrahim Salim Mansour (Ph.D. degree), Thermodynamic and kinetic studies for production of some types of dyes, Alexandria University, Egypt, 2008.

Research Associates and Postdocs Supervised

Missouri S&T

1. Dr. Yuan Zhou (February 2014 – Present); ***2. Dr. Amer Daham*** (April–December 2012); ***3. Dr. Saba Gheni*** (April-December 2012); ***4. Dr. Yasser*** (2012); ***5. Dr. Stoyan Nedeltchev*** (February 2010 - February 2012); ***6. Rahman Abdulmohsin*** (2009/2010); ***7. Dr. Fadha Ahmed*** (2010); ***8. Dr. Xingying Lan*** (2010/2011); ***9. Dr. Ghanim Maqbool alwan*** (2010/2011); ***10. Dr. Ahlam J. AbdulGhani*** (2011); ***11. Hayder Hassan Taha*** (2011); ***12. Yassif M. Ali*** (2011)

Washington University

1. Arnaud Denecheau (2007-2009); ***2. Dr. Gengzhi Yu*** (2007-2008); ***3. Dr. Fadha Ahmed*** (2005-2008); ***4. Dr. Ashraf Shahata*** (2006-2007); ***5. Dr. Keshav Ruthiya*** (2005-2006), ***6. Dr. F. Doering*** (2003-2004); ***7. Dr. K. Karim*** (2001-2004); ***8. N. Dromard*** (2001-2002); ***9. E. Erkoc*** (2002-2003); ***10. K. Koop*** (2002-2003); ***11. Delsart Olivier*** (2002-2003); ***12. M. Capitaine*** (2003-2006); ***13. Dr. A. Kemoun*** (1997-2001); ***14. Dr. B. Chen*** (2000-2001); ***15. Dr. M. Rafique*** (2000 – 2003); ***16. Dr. P. Spicka*** (2001-2002), ***17. Dr. Pascal Fongrland*** (2000-2002); ***18. Dr. Y. Wu*** (1999-2000); ***19. P-Y. Lanfrey*** (2005-2006)

Undergraduate Students Supervised

Missouri S&T

17. Alexandra Slimmer (2013/2014), ***16. Nicholas Staufenbiel*** (2013/2014), ***15. Ian P Tolan*** (***MIT,*** summer 2013), ***14. Erica Byerley*** (2013/2014), ***13. Hannah Jokisch*** (2013/2014), ***12. Amer AlLozi*** (2013/2014), ***11. Charlene Ruwwe*** (2010 to 2012), ***10. Ibrahim Al Bagawi*** (2011); ***9. Faiz Almansour*** (2011); ***8. Leonard Mitchell*** (2010/2011); ***7. Arch Creasy*** (2010); ***6. Monica Uhlmansiek*** (2010); ***5. Timothy Herbig*** (2010/2011); ***4. Andrew Naida*** (2010/2011); ***3. Kelly O'Breint*** (nuclear Engineering, 2009); ***2. Stephanie Hurtado*** (2009); ***1. Patricia Halier*** (2009)

Washington University

1. J. Grim (2008); ***2. B. white*** (2008); ***3. P. Vipul*** (2008); ***4 . Ray*** (2008); ***5. Brent*** (2007); ***6. Charles*** (2007); ***7. Siegle*** (2007); ***8. Derek Starkey*** (2007); ***9. Haoyung Liu*** (2007); ***10. Dan Szatkowski*** (2007); ***11. Tagreed Darwish*** (BS/MS, 2006/2007)***; 12. Stephanie Suen*** (2007/2008); ***13. Kelsy Sudart*** (2005/2006); ***14. Kessie Racek*** (2006); ***15. Jay Weber*** (2004/2005/2006); ***16. Robert McCarthy*** (2005/2006/2007); ***17. Jennifer Raiber*** (2006); ***18. Rebecca Weaver*** (2005); ***19. David Kettler*** (2001-2002); ***20. Bryan Danforth*** (2005); ***21. Sean Mueller*** (2004/2005); ***22. Murtaza Abbas*** (2003-2005); ***23. Criag Meyers*** (2005); ***24. Bia Henriques*** (2004); ***25. Wijdan Jailawi*** (2003, University of Houston); ***26. Rebecca Hoffman*** (2002-2003); ***27. Emily Martis*** (2004); ***28. Zach Lukens*** (2004/2005); ***29. Ajey Dambal*** (2000-2001); ***30. Amy Chen*** (2000-2001); ***31. Jason Nguyen*** (2000-2001); ***32. David Newton*** (2000-2001); ***33. David Cook*** (2000); ***34. David Koch*** (2000); ***35. Everett Scheer*** (2000); ***36. Guillermo Clavia*** (2000); ***37. Hadi Shaban*** (1999-2000); ***38. Boon Tee Ong*** (1999); ***39. Manahil Kadafur*** (1999); ***40. Robert Dodson*** (1999); ***41. Javier Alvare*** (1999); ***42. Christina Weigand*** (1999); ***43. Jonathan Mettes*** (1998-1999); ***44. Felipe Lembcke*** (1997); ***45. Chevette Jones*** (1995); ***46. Yasir Shariff*** (1995, Mechanical Engineering)

High School Students Supervised at Washington University (STARS Summer Program

1. Zachary Levinson (2008); ***2. Andy Stuhl*** (2007); ***3. Adam Rey*** (2006); ***4. Todd Frederick Romkema*** (2005); ***5. Stacy Devano*** (2004); ***6. Andy Kalcic*** (2003); ***7. Johnson Timothy Lee*** (2002); ***8. Tami Westover*** (2001); ***9. Robby Prasad*** (2000); ***10. Jason Mudd Robert*** (1999); ***11. Mathew Meuther*** (1998); ***12. Marc Friedman*** (1995).

Collaboration with Researchers and Professors

I have been in collaboration and have joint projects, publications and proposals with professors and from different departments at Washington University, Missouri S&T and other universities and scientists and engineers from different disciplines from National Laboratories and industries in US and around the world.

SERVICES

DEPARTMENT and SCHOOL SERVICES

Missouri S&T

- Member of the external functions and activities planning committee for Deans transition from no-Deans, February – April, 2014
- Chair of our department search committee for hiring assistant professor in 2011
- Chair of the ABET committee – chemical and biological engineering department, S&T
- Member of the committee for recruiting Laufer Chair in Energy under the supervision of the Chancellor
- Serving in all the department committees
- Working with the department academy and alumni for enhancing our department capacity – S&T
- Chairing the new building committee
- Serving on graduate students committees

Washington University

- Spearheaded the effort of revamping the capstone design course (2001 – 2007) to have the design projects performed at the local industry premises on real industrial problems. The motivation for this new successful endeavor is to include industrial interaction in our design course according to the ABET EC 2000 requirement.
- Radiation safety liaison (1994-2008) and chemical process safety liaison (2000-2008) for the Chemical Engineering Department.
- Established (in 2004) a procedure with the Washington University Environmental Health and Safety (EH&S) office for inspecting the department laboratories and for providing annual training to graduate and undergraduate students.
- Chair of the Chemical Process Safety Committee, which I formed for the Chemical Engineering Department (2000 – 2004). The committee includes experts on safety from local industry to evaluate and establish rules and procedures for the working conditions in the educational and research facilities.
- Member of the CEC (Center for Engineering Computing) Faculty Advisory Board Committee (1995 – 1997; 2005-2008).
- Chair of the Ad hoc committee for lab space for Chemical Engineering Department activities (2001-)
- Member of promotion committee for full professor (2006).
- Member of new faculty search committee (2006).
- Member of undergraduate department curriculum committee (1999 and 2001- 2008).
- Member of graduate curriculum committee (2003-2008).
- Member of graduate admitting committee (2004- 2008).
- Chair of the undergraduate laboratory committee (1999 – 2008).
- Academic advisor to 8-15 undergraduate students per year.
- Participated in obtaining ABET accreditation during the review process held in Fall 1994 and 2000. I prepared materials and manuals for the required courses I teach (ABET files for CS 265-section 2, ChE 374 and ChE 473). I successfully introduced design elements into these courses to fulfill the design credits assigned to these courses.

- Organized with Professor Babu Joseph a successful 2000 ASEE reception, Union Carbide lecture award and department laboratories tour during the 2000 ASEE (American Association of Engineering Education) annual meeting held in St, Louis, (June 18-21, 2000).
- Organized departmental tours for Washington University Parents visitors (April 2002-present) , attendees of many conferences and organizations meetings held in town (e.g. 2000 ASEE meeting, 2000 AAAR meeting, 2000 AIChE regional meeting, 1999 St. Louis AIChE meeting, etc.) and numerous CREL's laboratory tours for visitors from industry (1995- 2008).
- Served as a member for high school students research program administered by University of Missouri – St. Louis (NSF young scholar program), 1995, 1998-2008.
- ***Served on doctoral committees:*** P. Chen, K. Balakrishnan, K. Ng., A. Rammohan, M. Somasi, R. Smith., R. Fushimi, J. Banco (Electrical Engineering), D. Guha, M. Javidi, Sammy J. Showail (Business School), R. Jevtic, N. Subramanya, Xiaolin Zheng, M. Garcia.

PROFESSIONAL SERVICES

Editorial Board and Editing activities

- Member of the editorial board of Processes, MDPI, Basel, Switzerland, 2012.
- Guest Editor of Canadian Journal of Chemical Engineering, August 2010, Volume 88, Number 4, GLS-9 Special Issue
- Member of the international board of industrial process tomography (Manchester/Leeds, UK)
- Member of the international board of gas-liquid-solids (GLS) reactors engineering, USA
- Ex-Member of the advisory committee of the International Bhurban conference on applied sciences and technology, Pakistan
- Ex-Member of the editorial board of the International Journal of Chemical Engineering
- Ex-Member of the editorial board of NED University Journal of Research
- Co-Editor of the proceeding on Bioenergy-I international conference that I founded and Chaired
- Served as a program committee member for the International Conference on "Process Imaging for Automatic Control", SPIE (The International Society for Optical Engineering" Boston, MA, (November 5-8, 2000).

Proceedings

http://services.bepress.com/eci/

- **Volume P8: Bioenergy - I: From Concept to Commercial Processes, March 5-10, 2006**
  Editors: Dr. Muthanna Al-Dahhan, Washington University
  Dr. Kevin Hicks, ERRC/ARS/USDA
  Dr. Charles A. Abbas, Archer Daniels Midland Company

Panels

- A reviewer to the strategic plan of Petroleum Research and Studies Center of Kuwait Institute for Scientific Research (KISR), 2010/2011
- A member of a panel discussion – round table on the "Nuclear Technology Applied in Industrial Processes and Cultural Heritage Conservation", IX ENAN, Recife, Brazil, November, 28 2013.
- Panelist on DOE- NERI (Nuclear Energy Research Initiative) review meeting related to VHTRs (Very High Temperature Reactors), August 11-12, 2009, Salt Lake City, Utah.
- Panelist on clean coal utilization, Energy Summit, University of Missouri system, Columbia, Missouri, April 22-23, 2009.
- Panelist on how can we help higher education in Iraq, Iraqi Academics Conference sponsored by US national Academies, Washington DC, US Academies, March 14-15, 2009.
- A member of round table discussion on the "Scenario of the Nuclear Technology Industrial applications", IX ENAN (meeting on Nuclear Applications), Rio de Janeiro, Brazil, September 27 – October 2, 2009.

- Invited to be a member of a reviewing panel by NSF on US-Pakistan joint research projects, May 2010
- Reviewing member of NSF panels: Examples – Industrial Innovation and Partnership (SBIR/STTR) - Catalytic Processes and Technology, August 30, 2011; Bio-Based Chemicals, January 26, 2012; Catalytic Processes and Technology, February 22, 2012

Chairing and Organizing National and International Conferences

- Founded, Organized and chaired a new international conference on "Bioenergy I: from concept to commercial production", Tomar, Portugal, March 5-10, 2006 as part of the Engineering Conferences International (ECI) (Engineering Foundation conferences).
- Chaired in March 8-13, 2009 – Brazil, Rio de Janeiro the International conference on Bioenergy II - Fuels and Chemicals from Renewable Resources, Engineering Conferences International (ECI).
- Chaired and organized GLS9 (Gas-liquid-Solid reactors engineering) conference as part of the 8th World Congress on Chemical Engineering (WCCE8), Montreal, Canada, August 23-28, 2009.
- Chaired and organized an international conference on "Catalysis for Renewable Sources: Fuels, Energy, Chemicals", Tsars Village, St. Petersburg, Russia, June 28 – July 2, 2010.
- Member of scientific committee of Industrial Process Tomography Conferences – 6th International Symposium on Process Tomography, Cape Town, South Africa, March 26-28, 2012

Additional Professional Contributions and Services

- Reviewer to Nuclear Energy University Program (NEUP) – DOE, 2010 - Present
- Reviewer for establishing PhD program in Chemical Engineering at King Abdulaziz University – Jeddah – Saudi Arabia, May 2012.
- Member of scientific committee of the 6th International Symposium on Process Tomography, 26-28 March, 2012, Cape Town, South Africa
- Consultant to ADM (2010/2011) for the development of new process for converting byproducts from biodiesel process to useful products. My recommendations and analyses have been implemented and were of benefit to the process.
- Consultant to KISR (Kuwait institute for scientific research) (2010/2011) to provide recommendations and suggestion for facilities, personnel and research program development to convers KISR into center of excellence in the region and the world
- Two greener alkylation solid acid based catalyst processes that are currently licensed by both UOP and ABB Lummus were studied in our laboratory under my supervision.
- My work and report on Gas-Solid Monolithic Reactors has been summarized to become Chapter 27th in the Chemical Reactor OmniBook of Professor Octave Levenspiel, July 2002, ISBN-0-88246-173-7.
- In 2009 I was invited by Catalysis Group to author two chapters on scale-up of trickle bed reactors and fluidized bed as a major part of their specialized technical report to industrial sponsors.
- In 2007 I was invited and accepted to be on the editorial board of "Research Letters in Chemical Engineering," Journal.
- Invited (2007, 2008, 2009, 2011, 2012) as expert and on missions by International atomic Energy Agency (IAEA) and was selected as the chair of the experts meetings on disseminating the technology and knowledge of radioisotopes based techniques and their applications in industry to the developed, developing and underdevelopment countries.
- In 2007, I was selected to chair GLS 9 (Gas-liquid and gas-liquid-solid Reaction Engineering) in August 2009 in Montreal, Canada, with a theme on renewable and sustainable energy and environment.
- In 2007 I was selected and chaired in March 8-13, 2009 – Brazil, Rio de Janeiro the International conference on Bioenergy II - Fuels and Chemicals from Renewable Resources, Engineering Conferences International (ECI).
- Successfully organized every year since 1994 to 2008 our laboratory annual technical meeting with industrial and governmental sponsors (1994-2008).
- Successfully organized technical review meeting twice a year from 1999 to 2008 for the high pressure slurry bubble column consortium supported by Air Products and Chemicals, Conoco, Sasol (South

Africa), Statoil (Norway), Johnson Matthey Catalyst (UK), with DuPont, Ohio state University and Rensselaer Polytechnic Institute participation.

- Member of the technical committee of the 3rd and 4th world congress of industrial process tomography – Banff Canada (2003) and Aziu, Japan (2005).
- Founded and chaired many technical sessions in national and international conferences, selected examples below.
- Chaired numerous technical sessions in national and international conferences, selected examples below.
- Chaired a session in GLS 8, December 16-19, 2007, New Delhi, India
- Chaired a session in IBCAST07, January 8-12, 2007, Pakistan.
- Chaired a session in the APCChE06-11th Asian pacific confederation of chemical engineering, Kuala Lumpur, Malaysia, August 2006.
- Chaired a session in CHEMCON-5, New Delhi, India, December, 2005.
- Session Chair – Process Improvement in Manufacturing, 2002 Spring AIChE Meeting, New Orleans, LA, (March 10-14, 2002).
- Chaired a session in AIChE annual meeting (2002 – present) on Recent Advances on Bioreactors .
- Organized and chaired 2 sessions and co-chair a session on Multiphase Reaction Engineering in Honor of Professor Mike Dudukovic in 2004 AIChE annual meeting, Austin, Texas.
- Chaired a session on multiphase reactors in 2004 AIChE annual meeting, Austin, Texas.
- Chaired a session in ISAHOF, Oaxaca, Mexico, April 2004.
- Founded and Chaired sessions on Flow visualization and tomography in reaction engineering I&II and on advances on multiphase reactors in 2003 AIChE annual meeting, san Francisco, CA.
- Chaired and Co-Chaired sessions in the 3rd world congress of industrial process tomography, Banff Canada (2003).
- Co-Chaired a session on New developments in multiphase reactors in 2002 AIChE annual meeting, Indianapolis, Indiana.
- Chaired a session on bioreactors which I formed in the 2000 AIChE annual meeting to present – Multiphase Reactors in Biochemical Technology: Modeling, Experimentation and Applications.
- Chaired a session entitled "Multiphase Catalytic Reactors Engineering" at the 16th Canadian Symposium on Catalysis, Banff, Canada, (May 23-26, 2000).
- Served as a program committee member for the International Conference on "Process Imaging for Automatic Control", SPIE (The International Society for Optical Engineering" Boston, MA, (November 5-8, 2000).
- Chaired a session entitled "Radiometric Tomography" at the 2000 SPIE – Process Imaging for Automatic Control, Boston, MA, (November 6, 2000).
- Co-chaired a session entitled "Computational Fluid Dynamics and Mixing" at the 17th Biennial North American Mixing Conference, Banff, Canada, (August 15-20, 1999).
- Organized a workshop on Fluent CFD code at the Chemical Engineering Department, (October 13, 2000).
- Chaired a session entitled "Fluidized Bed Reactors" – ISCRE 15 (International Symposium on Chemical Reaction Engineering), Newport, CA, (September 13-16, 1998).
- Co-chaired as session on multiphase reactors – 1995 AIChE annual meeting, Miami Beach, Florida, (November 12-17, 1995).
- Reviewer to many technical Journals such as for example Chemical Engineering Science, AIChE J., I&EC Research, J. of Powder Technology, Biotech. and Bioengr. J., Biomass and Bioenergy J., Canadian Journal of Chemical Engineering, Catalysis Today, Chem. Engr. Comm., Chem. Engr. Educat., Flow Measurement and Instrumentation, Trans. IChemE, and others.
- Reviewed proposals submitted to national and international funding organizations (e.g. Petroleum Research Fund (PRF), DOE, UCR-DOE, NSF, NEUP - DOE, San Diego State University - Research

Foundation, US civilian research and development foundation (CRDF), NSERC/CRSNG-Canada, Volkswagen Foundation-Germany, Ministry of Science and Technology – Slovenia, and others).

PROFESSIONAL AFFILIATION

American Institute for Chemical Engineers, USA (AIChE) – life time member
American Chemical Society (ACS)
American Nuclear Society (ANS)

CONSULTATIONS

- Dow Chemicals (2013-Present), Synsel (2012-Present), Rentech (2012), Sub-S Corporation (2011-Present), Adaptive ARC (2011-2013), ADM (2010/2011), KISR (Kuwait institute of scientific research) (2010/2011), Catalysis Group (2009/2010)
- Detla T, Syntroleum, Tulsa, OK, Rentech, Denver, CO, ADM, Decatur, IL, SABIC, Riyadh, Saudi Arabia, King Abdulaziz University, Jeddah, Saudi Arabia, HOK Group, St. Louis, MO, ExxonMobil, Chevron, ChevronPhillips Chemicals, IAEA (Vienna), Sasol (South Africa), UiTM, Shah Alam, Malaysia.
- I provided to the Chemical Reaction Engineering Laboratory (CREL) sponsors consultations as part of CREL service to and interaction with its industrial sponsors. Each year, individuals from these companies visit CREL for such service and interaction.

RESEARCH & SCHOLARLY ACTIVITIES - CONTINUE

INVITED KEYNOTES AND PLENARY LECTURES

In addition to 98 invited talks and 342 conferences presentations – see below after publications

30. M. Al-Dahhan **(2013)** Advancing Multiphase Processes for Sustainable and Cleaner Energy, Products and Environment via Sophisticated Techniques, 1st National Conference on Environment, Environmental Research Center, University of Technology, Baghdad, Iraq, December 29-31, 2013.
29. M. Al-Dahhan **(2013)** Industrial Process Tomography and Visualization Using Nuclear Technology, IX ENAN, the 2013 International Nuclear Atlantic Conference (INAC 2013), Recife, Brazil, November 24-29, 2013.
28. M. Al-Dahhan **(2012)** Benchmarking Multiphase CFD Results via Sophisticated Experimental Measurements Techniques and Facilities, Trends in Physical and Numerical Modeling for Industrial Multiphase Flows, CFD and its experimental validation for multiphase flows: the state of the art, Cargese, Corsica, France, September 24-28, 2012.
27. M. Al-Dahhan, **(2012)** How Laboratory Investigation Assist Process Commercialization – Selected Examples Including Scale-up Methodology, International Mexican Congress on Chemical Reaction Engineering, Ixtapa, Mexico, June 10-12, 2012.
26. M. H. Al-Dahhan, **(2011)** Recent Research and Development of Various Processes for Sustainable Energy and Environment, The Role of Chemical Engineering in Developing National Economy, Saudi Chemical Engineer's First Forum, May 17-18, 2011 – Riyadh, King Saud University
25. M. H. Al-Dahhan, **(2010)** Twining the Research of Higher Education in Iraq with the World Universities for Lifting the Quality of MS and PhD Research" 2nd conference of the Academic Quality and accreditation, Ministry of Higher Education and Scientific Research of Iraq, Kufa University, Kufa, Iraq, December 26-28, 2010.
25. M. H. Al-Dahhan, **(2010)** Cleaner and Efficient Coal Utilization: For Coal to be An Essential Part of Sustainable US Energy Solution , 2010 SAME Missouri River/Texoma Regional and Midwest Levee Conference – Society of American Military Engineers (SAME), St. Louis, July 12-14, 2010
24. M. H. Al-Dahhan, **(2010)** Advancement of catalytic Fischer-Tropsch slurry bubble columns via advanced measurement techniques for renewable fuels, Energy and Chemicals production, International Conference on Catalysis for Renewable Sources: Fuels, Energy, Chemicals, Tsars Village, St. Petersburg, Russia, June 28 – July 2, 2010.
23. M. H. Al-Dahhan, **(2009)** Prospective of nuclear imaging and visualization in industrial processes, IX ENAN (meeting on nuclear applications, INAC 2009 (International Nuclear Atlantic Conference), ENIN (meeting on nuclear industries, XVI ENFIR (meeting on reactor physics and thermal hydraulics), Rio de Janeiro, Brazil, September 27 – October 2, 2009.
22. Al-Dahhan, M.H., **(2009)** Integrating Iraqi Scientific and Technological Research and Higher Education with the World Leading Centers and Institutions: How to help Iraqi R&D and higher education, How to create an international partnerships for science and technology: sustainable energy and environment, How to bridge the gap between scientific and technological R&D and industry needs – translating research results into applications; Sponsored by Prime Minister of Iraq; Ministry of Science and Technology, June 22-24, Baghdad, Iraq.
21. Al-Dahhan, M.H., Luo, H.-P., **(2008)** A novel multi-scale modeling approach for microalgae growth in multiphase photo bioreactors for bioenergy and power plant flue gas treatment, CLRI Dr. Y. Nayudamma Distinguished Speaker Award, USA-India on Energy and Sustainability Symposium, CHEMCON-08, Chantigarh, Punjab, India, December 28-30.
20. Al-Dahhan, M.H., **(2008)** Radioisotope applications in the petrochemical industry: An overview, plenary lecture, International Symposium on the Peaceful Applications of Nuclear Technology in the Gulf Cooperation Council (GCC) Countries, November 3-7, 2008, Jeddah, Saudi Arabia.
19. Al-Dahhan, M.H.; Yablonsky, G.S.; Gleaves, J.T.; Zheng, X.; Feres, R., **(2008)** Getting to the point:

From molecular to process scales, XVIII International Conference on Chemical Reactors, Malta, September 29 to October 3, 2008**.**

18. M. H. Al-Dahhan, Huping Luo, **(2007)** Can CFD be used to predict culturing photosynthetic cultures for bioenergy production and flue gas treatment? Invited plenary lecture, IBCAST – 2007, January 8-12, Pakistan.

17. M.H. Al-Dahhan, Mehul Vesvikar, **(2007)** Comparison between hydrodynamics of lab and pilot scale gas recirculation digesters for bioenergy production using CFD and its evaluation versus experimental data, Invited plenary lecture, IBCAST – 2007, January 8-12, Pakistan.

16. Muthanna Al-Dahhan, Huping Luo, **(2007)** Intensification of Microalgae culturing in photo bioreactors for renewable energy via novel modeling approach", invited plenary lecture, Slovak Society of Chemical Engineering, 34th International Conference of Tatranske Matliare, Slovakia, May 21-25.

15. Muthanna Al-Dahhan, **(2007)** Advancement of trickle bed reactors and their scale-up for clean fuels and chemicals production, International Symposium on Advances in Hydroprocessing of Oil Fractions (ISAHOF 2007), Morelia, Michoacan, Mexico, June 26-29.

14. Muthanna Al-Dahhan, **(2007)** FT Synthesis for clean alternative energy – Industry and Academia collaboration, Invited Plenary talk, Idaho Academy of Science Symposium, Synthetic fuels, April 19-21.

13. Muthanna Al-Dahhan, **(2007)** Recent advances in Radioactive Particle Tracking techniques, International Atomic Energy Agency, Consultants meeting, Vienna, Austria, October 22.

12. Al-Dahhan, M. H., **(2006)** Advances in Reactor Technology for Fischer-Tropsch Synthesis with Biomass as a Feedstock: A New Methodology for Scale-up of Bubble Column Reactors. Invited Plenary Lecture, BTLtech06, (Biomass to liquid fuels and chemicals tech), Munich, Germany, October 16-17.

11. Muthanna Al-Dahhan, Huping Luo, Prediction of microalgae culture growth in photo bioreactors using CFD, IBCAST 2005, 4th International Bhurban Conference on Applied Sciences, Pakistan, June 16-18, 2005.

10. Al-Dahhan, M.H., **(2006)** Culturing Microalgae in Photo bioreactors: Advanced Modeling and Experimentation, Invited Plenary lecture, South African Chemical Engineering Congress, 20-22, September, Durban, South Africa.

9. M.P. Dudukovic and M.H. Al-Dahhan **(2006)** Multiphase Reaction in Bioenergy production, Bioenergy I: from concept to commercial production, ECI, Plenary lecture, Tomar, Portugal, March 5-10.

8. Muthanna Al-Dahhan, Huping Luo, **(2005)** Advanced modeling and experimentation of the microalgae growth in photo bioreactors", Invited Plenary lecture, International Seminar on Advances in Chemical Engineering, UICT, Institute of Chemical Technology, University of Mumbai, December.

7. Al-Dahhan, M.; Shaikh A. **(2005).** A New Mechanistic Methodology for Scale-up of Bubble Column Reactors. ***Plenary Lecture***, *5th International Chemical Engineering Conference, Amman, Jordan, September 12-14.*

6. M. Al-Dahhan, H.L. Luo, **(2005)**. Microalgae Culture Growth with the Help of CFD. Plenary Lecture, 4th International Bhurban Conference on Applied Sciences and Technology, Bhurban, Pakistan, June 13-18.

5. Al-Dahhan, M. H., Palmisano, E., Ramachandran, P. A., Balakrishna, K., **(2004)** Computation of effectiveness factors for partially wetted complex catalyst shapes using the method of fundamental solution, Keynote Lecture ISAHOF, Oaxaca, Mexico, 18-22 April.

4. Al-Dahhan, M. H.; Shaikh, A.; Rados, N. **(2003).** Phase Distribution in a High Pressure Slurry Bubble Column via Computed Tomography, Keynote Lecture, *3rd world Congress on Industrial Tomography*, Banff, Canada, September 2-5.

3. Muthanna Al-Dahhan, **(2001)** "Tomography and velocimetry for multiphase reactors: A perspective from the USA", overview plenary lecture, 2nd World Congress on Industrial Process Tomography, Hannover, Germany, August, 29-31

2. Muthanna Al-Dahhan, **(2001)** "Engineering studies of photo bioreactors via advanced diagnostic techniques, keynote lecture, Biochemical Engineering XII: Back to future: application of biochemical engineering fundamentals to modern problems", Marine Biotechnology, Rohnert Park, CA, June 10-15.

1. Muthanna Al-Dahhan, (2000), STARS Summer Program – Review, University of Missouri in St. Louis, Invited to represent Washington University Faculty, July 28.

PUBLICATIONS

A. PEER REVIEWED JOURNALS

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152. Albdiri Amer, Aastha Ojha and Muthanna Al-Dahhan, **(2014)**, Study of local gas holdup and interfacial area in a split-column airlift bioreactor using sophisticated 4-point optical probe for culturing microalgae/cyanobacteria, Chemical Engineering Communication (Accepted)

151. Alwan, G. M., Aradhya, S.B, Al-Dahhan, M.H., **(2014)** Study of solids and gas distribution in spouted bed operated In stable and unstable conditions, Int. Journal of Engineering Research and Applications www.ijera.com ISSN : 2248-9622, Vol. 4, Issue 2 (Version 1), February 2014, pp.01

150. Muthanna Al-Dahhan, Shreekanta Aradhya, Faraj Zaid, Neven Ali and Thaar Aljuwaya, **(2013)**, Scale-up and on-line monitoring of gas-solid systems using advanced and non-invasive measurement techniques, SYMPHOS 2013

149. Yuan Zhou, M.P. Dudukovic, Hui Liu, and Muthanna Al-Dahhan, **(2014)**, Multiphase hydrodynamics and distribution characteristics in a monolith bed measured by optical fiber probe, AIChE J., Vol. 60, No. 2, 740-748

148. Shaikh, A. and Al-Dahhan, M, Scale-up of bubble column reactors: A review of current state-of-the-art, I&EC Research (Accepted in 2013)

147. Shaikh, A. and Al-Dahhan, M. H., A New Method for Online Flow Regime Monitoring in Bubble Column Reactors, Chemical Engineering Science (Accepted)

146. Youssef, A., Hamed, M., Grimes, J., Al-Dahhan, M., and Duduković, M. P., **(2013)**, Hydrodynamics of pilot scale bubble columns: Effect of internals, Ind. & Eng. Chem. Res., 52 (1)

145. Youssef, A. A., Al-Dahhan, M. H., and Dudukovic, M.P., **(2013)**, Bubble columns with internals: A review, International Journal of Chemical Reactor Engineering, 11 (1)

144. Youssef, A.A., Hamed, M.E., Al-Dahhan, M.H., Dudukovic, M.P. **(2013)** A New Approach for Scale-up of Bubble Column Reactors, Chemical Engineering Research and Design (2013), http://dx.doi.org/10.1016/j.cherd.2013.12.011

143. Ghanim Maqbool, Muthanna Al-Dahhan, Faroow a. Mehdi **(2012)**, Multi-objective optimization of a spouted bed reactor: Improving the stability and operability, 1st edition, Lambert Academic publishing GmbH Co.kG, 978-3-8473-4024-9

142. Nedeltchev, S., Aradhya, S., Zaid, F., Al-Dahhan, M. **(2012)**, Flow regime identification in three multiphase reactors based on Kolmogorov entropies derived from gauge pressure fluctuations**,** Journal of Chemical Engineering of Japan 45 (9) , pp. 757-764

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99. Varma R., Al-Dahhan M. **(2007)**, Effect of sparger design on hydrodynamics of a gas recirculation anaerobic bioreactor, Biotechnology and Bioengineering, 98: 6, December 15, 1146-1160.
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8. Gupta, P., M.H. Al-Dahhan, M.P. Dudukovic, P.L. Mills, T.M. Leib, J.J. Lerou, **(2001),** Liquid-phase tracer responses in a cold-flow trayed bubble column from conductivity probe measurements", Gas-Liquid Solid Topical Conference Proceeding, 6th World Congress of Chemical Engineering, September 2001, Melbourne, Australia
7. S. Roy, F. Larachi, M.H. Al-Dahhan, M.P. Dudukovic, **(2001)**, Resolution And Sensitivity In Computer Automated Radioactive Particle Tracking (CARPT), Proc. SPIE, The International Society for Optical Engineering, vol. 4188, 122-133, **(2001),** Process imaging for automatic control, SPIE, Int. Symposium on Intelligent Systems for Advanced Manufacturing , (Boston, Nov. 5-8, 2000)
6. Muthanna H. Al-Dahhan, **(2000),** Integration of design and selected process engineering components into the unit operations laboratory, 2000 ASEE Proceedings (Refereed paper in proceedings), S-2559.
5. Muthanna H. Al-Dahhan, Steve Picker, Christina Weigand, Amy Chen, **(2000),** Development of a biochemical experiment for the unit operations laboratory through an undergraduate research project", 2000 ASEE Proceeding (Refereed paper in proceeding), S-2513
4. S. Roy, F. Larachi, Muthanna H. Al-Dahhan, M.P. Dudukovic, **(2000),** A theoretical investigation of resolution and sensitivity in computer automated radioactive particle tracking (CARPT), process imaging for automatic control, (Refereed paper in proceeding), SPIE Int. Symp. On Intelligent Systems for Advanced Manufacturing, Boston, November 5-8
3. F. Larachi, M. H. Al-Dahhan, M. P. Dudukovic, A. Laurent, **(1996)**, High pressure trickle-bed reactors: a state -of-the-art review, Proceeding of the 12th International Congress of Chemical and Process Engineering, CHISA'12, Prague, Czech Rep., August 25-30
2. M. H. Al-Dahhan, Y. Wu, M. R. Khadilkar, M. P. Dudukovic, **(1996)**, Improved prediction of pressure drop and liquid holdup in high pressure trickle-bed reactors", Proceeding of the 5th World Congress on the Chemical Engineering, San Diego, Vol. I, 209
1. Muthanna H. Al-Dahhan, **(1995)**, Computing and computer applications in engineering education", The Proceeding of 4th World Conference on Engineering Education, Vol. II, 1, October 15-20, Minneapolis/St. Paul, Minnesota

C. NON-REVIEWED PUBLICATIONS IN CONFERENCE PROCEEDINGS

13. Khairul Anuar Mohd Salleh, Hyoung Koo Lee, Muthanna H. Al-Dahhan **(2013)**, New local liquid velocity measurement technique in Trickle Bed Reactors (TBRs) using X-ray Digital Industrial Radiography and Particle Tracking (DRPT) techniques, 9444, 2013 American Nuclear Society Winter Meeting and Nuclear Technology Expo, Washington, DC, November 10-14, 2013
12. M.O. Kagumba, Y. Abdulaziz, and M.H. Al-Dahhan, **(2012)**, Effect of Internals and Solids Loading on Bubble Dynamics in Slurry Bubble Columns, 2012 AIChE Annual Meeting, October 28-November 2, David L. Lawrence Convention Center, Pittsburgh PA, U.S.A
11. Gahnim M. Alwan, Muthanna Al-Dahhan, **(2011)**, Simulation and multi-objective optimization of a continuous biochemical reactor using multilayer modeling technique, Proceeding of AIChE-2011 Annual Meeting, October 16-21, Minnesota
10. Gahnim M. Alwan, Muthanna Al-Dahhan, **(2011)**, Multi-objective optimization of autothermal catalytic membrane reactor using genetic algorithm, Proceeding of AIChE-2011 Annual Meeting, October 16-21, Minnesota
9. G. M. Alwan, S. Nedeltchev, S. Aradhya and M. Al-Dahhan, **(2011)**, Multi-objective Optimization of a Spouted Bed Reactor, Proceeding of AIChE Annual Meeting, Minneapolis, Minnesota (USA), October 16-21
8. D. Tasmatsoulis, Muthanna H. Al-Dahhan, F. Larachi, N. Papayannakos, (**2000**) "The effect of particle dilution on the wetting efficiency and liquid film thickness in small trickle beds", Proceedings of the 3rd Int. Symp. Catalysis in Multiphase Reactors, Naples, Italy, May 29-31.

7. Y. Jiang, Muthanna H. Al-Dahhan, M.P. Dudukovic, (**2000**) "CFD modeling of multiphase flow distribution in catalytic packed-bed reactors: scale down issues", Proceedings of the 3rd Int. Symp. In Catalysis in Multiphase Reactors, Naples, Italy, May 29-31.
6. Y. Jiang, Muthanna H. Al-Dahhan, M.P. Dudukovic, (**2000**) "A parallel approach to catalyst and reactor selection for fine chemical processes", Proceedings of the 3rd Int. Symp. In Catalysis in Multiphase Reactors, Naples, Italy, May 29-31.
5. S. Roy, J. Chen, S. Dgaleesan, P. Gupta, M.H. Al-Dahhan, M.P. Dudukovic, (**1998**) "Non-invasive flow monitoring in opaque multiphase reactors via CARPT and CT", Proceeding of FDESM' 98 [FDESM98-5077], 1998 ASME Fluids Engineering Division Summer Meeting, June 1998, 245, 7/50-7/68
4. S. Degaleesan, P. Gupta, J. Chen, M. H. Al-Dahhan, M. P. Dudukovic, B.A. Toseland, B. L. Bhatt, (**1997**) "Progress in understanding the fluid dynamics of babble column reactors", Published in the DOE Annual Review Report, Pittsburgh, PA
3. Y. Wu, M. Khadilkar, M. H. Al-Dahhan, M. P. Dudukovic, (**1997**) "Effect of catalyst wetting on the performance of trickle-bed reactors", Proceeding of the Second Joint U.S./China Chemical Engineering Conference, Beijing, China, May 19-22, page 234
2. M. P. Dudukovic, M. H. Al-Dahhan, M. Khadilkar, Y. Wu, (**1997**) "Study of trickle-bed reactor performance under periodic operation", Proceeding of the Second Joint U.S./China Chemical Engineering Conference, Beijing, China, May 19-22, page 286
1. M. H. Al-Dahhan and M. P. Dudukovic, (**1995**) "Liquid catalyst contacting efficiency in high pressure trickle-bed reactors with/without fines", Extended Abstract, The second Italian Conference on Chemical Process Engineering, Firenze, 15-17 May.

D. RECENT TECHNICAL REPORTS

- Technical report to Rentech on assessing the risk and the mitigation of scaled up FT slurry bubble column reactor for biodiesel, 2013
- Technical report to ADM on assessing the design and performance of aqueous hydrotreating trickle bed reactors, 2012
- Two technical reports to KISR – Kuwait on OCR unit, 2013
- Quarterly reports and final reports for the DOE-NERI two grants outlined above.
- Two Chapters (2009), one on scale-up of trickle bed reactors and another one on scale-up of fluidized beds in a specialized technical report edited by Catalysis Group and submitted to its industrial sponsors.
- Edited and developed CREL annual technical reports (1994/1995 to 2007/2008). The annual report summarizes the progress accomplished on all CREL's research projects excluding the research contracts with sponsored companies. It is distributed to all CREL's sponsors.
- Co-Authored final report to DOE (2007) on "Improved Biomass Utilization in Digester through Remote Flow Sensing" DOE/Energy Efficiency Science Initiative, 2001-2007.
- Co-authored Sandia National Laboratory report (2006) on circulating Fluidized Bed Hydrodynamics Experiments for Multiphase Fluid Dynamics Research Consortium (MFDRC), SAND Report, SAND 2006-4914.
- Co- authored IAEA (International Atomic Energy Agency) consultants meeting (CM) report (2008) on radiometric techniques for multiphase flow systems, October, 2008, IAEA, Vienna, Austria.
- Co-authored IAEA (International Atomic Energy Agency) consultants meeting (CM) report (2007) on radioactive particle tracking techniques for investigation of industrial reactors, October 22-25, IAEA, Vienna, Austria.
- Co-authored and supervised numerous monthly, quarterly and final reports submitted to the research sponsors for all the grants as PI, Co-PI and Co-Investigator listed in the grants section.
- Co-authored and supervised the quarterly report to DOE on "Improved Biomass Utilization in Digester through Remote Flow Sensing" DOE/Energy Efficiency Science Initiative, October 2001- March 2007.

- Authored the quarterly progress reports for the high pressure slurry bubble column consortium, 1999 to present.
- Co-authored and supervised the annual reports and final report on "Advanced Diagnostics Techniques for Three-Phase Slurry Bubble Column Reactors", for the DOE grant – DE-FG-26-99FT40594, July 2000 - 2002.
- Co-authored the final technical report "Flow distribution in laboratory and pilot plant fixed bed reactor packed with structured packing, June 2001.
- Co-authored and supervised the extensive technical review on the bubble column submitted to the High Pressure Slurry Bubble Column Consortium which is sponsored by Air Products and Chemicals (USA), Conoco (USA), Sasol (South Africa), and Statoil (Norway).
- Co-author of the Annual Technical Reports for years 1, 2 & 3, Novel Techniques for Slurry Bubble Column Hydrodynamics, Submitted by Washington University, Ohio State University and Exxon research and Engineering to DOE, DOE-FG22-95PC95212.
- Co-author of monthly, quarterly and topical reports on Engineering Development of Slurry Bubble Column Reactor Technology, Submitted to Air Products - DOE, DOE FC22-95PC95051 Via Air Products (1996- present).
- Author of the final technical report "Hydrodynamic Study in an Ebullated Bed" submitted to UOP LLC for the performed research contract (January 1, 1998 – May 31, 1999), March, 1999.
- Co-author of the final technical report "Implementation of Computer Automated Radioactive Particle Tracking (CARPT) on a Gas-Solid Riser: Experiment Design and Analysis" submitted to Sandia National Laboratory and Chevron for the fund received as a part of Multiphase Fluid Dynamics Research Consortium (MFDRC), October, 1999.
- Co-author of the final technical report "Hydrodynamics of countercurrent Bubble column with internals" submitted to DuPont for the performed research contract, (1998).
- Co-author of the final technical report "Study of Particle Motion on Packed/Ebullated Beds By Computer Automated Radioactive Particle Tracking (CARPT) and Computed Tomography (CT)"submitted to Chevron for the performed research contract, (April, 1998).
- Co-author of the final technical report "Hydrodynamic Studies of Liquid-Solid Riser Flow" submitted to UOP for the performed research contract (September 1, 1995 – March 31, 1996), (April, 1996).
- Co-author of the final technical report "Investigation of High Selectivity, High Volumetric Productivity Reactor for Production of Amino Alcohol" submitted to Monsanto for the performed research contract, (December, 1996).

E. OTHER TECHNICAL REPORTS

- My work and report on Gas-Solid Monolithic Reactors has been summarized to become Chapter 27th in the Chemical Reactor OmniBook of Professor Octave Levenspiel, July 2002, ISBN-0-88246-173-7.
- Authored reports on the following topics: General electric ring opening polymerization products properties, 1989; Modeling of mechanically agitated three phase slurry reactors, 1989; Reverse osmosis membranes, 1987; Monolith catalytic reactors, 1987; Two phase flow, 1986; and Capillary tube viscometer design, 1986.
- Authored a comprehensive technical and operating manual for the pilot research facilities in which I worked, 1983.
- Wrote about 3 to 4 technical and research reports a year, 1982 - 1985.

PRESENTATIONS

A. INVITED KEYNOTE AND PLENARY LECTURES:

30 Plenary/Keynote lectures, See above before publications

B. INVITED TALKS

98. Muthanna Al-Dahhan **(2013)** Thoughts on Engineering Education and Industrial Interactions, Engineering College, Koya University, Kurdistan, February 2, 2014

97. Muthanna Al-Dahhan **(2013)** Quality Assurance in Engineering Education toward Accreditation, University of Technology, Baghdad, Iraq, December 31, 2013

96. Muthanna Al-Dahhan **(2013)** Advancing Multiphase Processes and Benchmarking Computational Models and Simulations through Sophisticated State-Of-The-Art Measurement and Monitoring Techniques**,** OCP – Phosphate and its derivatives, El-Jadida, Morocco, July 4, 2013

95. Muthanna Al-Dahhan **(2013)** Application of Nuclear Techniques in Industry: Lab and Fields Techniques, National Workshop on Applications of Nuclear Techniques in Industry Sponsored by IAEA and KISR-Kuwait, June 25-26, 2013

94. Muthanna Al-Dahhan **(2013)** State-of-the-Art Sophisticated Techniques for Advancing Multiphase Flow Processes, National Workshop on Applications of Nuclear Techniques in Industry Sponsored by IAEA and KISR-Kuwait, June 25-26, 2013

93. Muthanna Al-Dahhan **(2013)** Nuclear safety and QA in Labs for Nuclear Techniques for Industrial Applications, National Workshop on Applications of Nuclear Techniques in Industry Sponsored by IAEA and KISR-Kuwait, June 25-26, 2013

92. Muthanna Al-Dahhan, M. Al-Mesfer, M. Kagumba, A. Sheikh, **(2013)** Gas Conversion to Clean Liquid Fuels via Fischer-Tropsch Slurry Bubble Column – Some Recent Advances, 7th Sino-US, Beijing, China, October 14-18, 2013

91. Muthanna Al-Dahhan, Shreekanta Aradhya, Faraj Zaid, Neven Ali and Thaar Aljuwaya, **(2013)**, Scale-up and on-line monitoring of gas-solid systems using advanced and non-invasive measurement techniques, International Symposium SYMPHOS, Morocco, Agadir, May 6-10, 2013

90. M. H. Al-Dahhan, **(2012)** Means for curricula improvement and modernization, teaching methods, educational technologies, and ways for establishing effective collaboration with foreign universities, 3rd International Conference on Development of Higher education in Iraq, Baghdad, Iraq, November 27-29, 2012

89. M. H. Al-Dahhan, **(2012)** Recent advances in selected routes for alternative energy, 3rd International Conference on Development of Higher education in Iraq, Baghdad, Iraq, November 27-29, 2012

88. M. H. Al-Dahhan, **(2012)** Applications of nuclear based measurement and monitoring techniques in industry with special focus on oil industry, KISR (Kuwait Institute for Scientific Research), Kuwait, August 14, 2012

87. M. H. Al-Dahhan, **(2012)** Radiation safety for nuclear based measurement and monitoring techniques in industry, KISR (Kuwait Institute for Scientific Research), Kuwait, August 14, 2012.

86. M. H. Al-Dahhan, **(2012)** Benchmarking Computational Fluid Dynamics (CFD) Using Advanced Measurement Techniques, Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA, July 24, 2012.

85. M. H. Al-Dahhan, **(2011)** How lab Studies could enable Commercialization: Selected Examples Including Scale-up Methodology, Kuwait Institute of Scientific Research (KISR), Kuwait, July 5, 2011

84. M. H. Al-Dahhan, **(2011)** Scale-up of Bubble Columns, SABIC R&D, Riyadh, Saudi Arabia, May 17, 2010

83. M. H. Al-Dahhan, **(2011)** Recent Advancement of Multiphase Reactors, SABIC headquarter, Riyadh, Saudi Arabia, May 16, 2011

82. M. H. Al-Dahhan, **(2011)** Energy from Sustainable Biomass Conversion Technologies, Sustainable Energy Technologies (SET), May 21, 2011 – Riyadh, King Saud University

81. M. H. Al-Dahhan, **(2011)** Advancing Multiphase Processes for Sustainable and Clean Energy and Environment via Sophisticated Techniques, TU Braunschweig, Germany, March 17, 2011

80. M. H. Al-Dahhan, **(2011)** Role of Radioisotopes Based Techniques in Advancing Multiphase Flow Reactors and Systems, Institute of Safety Research, Experimental Thermal Fluid Dynamics, Dresden - March 16, 2011
79. M. H. Al-Dahhan, **(2011)** Current Trends on Gas-Liquid-Solid Reaction Engineering Trends in Multiphase Reactor Design, Chemical Reaction Engineering – Technical University Dresden, Sponsored by Federal Ministry of Education and Research, March 14-16, 2011, Dresden - Germany
78. M. H. Al-Dahhan, O. Sitton, N. Book, J.-C. Wang, D. Ludlow, **(2010)** Assessment of Engineering and Science Undergraduate programs, University of Al-Muthanna, Iraq, December 30, 2010
77. M. H. Al-Dahhan, O. Sitton, N. Book, J.-C. Wang, D. Ludlow, **(2010)** Assessment of Engineering and Science Undergraduate programs for lifting the quality of Education in Iraq, Engineering College, University of Kufa, Iraq, December 28, 2010
76. M. H. Al-Dahhan, **(2010)** Research and Development (R&D) of Various Processes for Sustainable Energy and Environment, Indo-US Workshop on Energy and Environment: Challenges & Research Opportunities, December 12-15, 2010 – New Delhi
75. M. H. Al-Dahhan, **(2010)** Advancement of Multiphase Flow Reactors and Systems via Development of Advanced Non-Invasive Radioisotopes Based Techniques, Chemical and Nuclear Engineering Department, University of New Mexico, October 26, 1010
74. M. H. Al-Dahhan, **(2010)** Bioenergy from Biomass, Institute Mexico del Petroleum (IMP), Mexico City, Mexico, June 17, 2010
73. M. H. Al-Dahhan **(2010)**, Radioisotopes application in industry, AIChE Chapter, Chemical and Biological Engineering Department, April 2010
72. M. H. Al-Dahhan **(2009)**, Microalgae as a promising source of bioenergy, Karbala University, Karbala, Iraq, December 24, 2009.
71. M. H. Al-Dahhan **(2009)**, Overview of bioenergy production, Special Symposium on Bioenergy, Al-Nahrain University, Baghdad, Iraq, December 23, 2009.
70. M. H. Al-Dahhan **(2009)**, Recent advances in multiphase reactors, Al-Naharain University, Baghdad, Iraq, December 23, 2009.
69. M. H. Al-Dahhan **(2009)**, Advanced measurement techniques for multiphase flow systems, College of Engineering, Al-Mustansyria University, Baghdad, Iraq, December 22, 2009.
68. M. H. Al-Dahhan **(2009)**, Multiphase reactors for clean fuels and chemicals, chemical Engineering Department, University of Baghdad, Baghdad, Iraq, December 21, 2009
67. M. H. Al-Dahhan, Shrekanta B. Aradhya, Advancing the Fundamental Understanding and Scale-up of TRISO Fuel Coaters via Advanced Measurement and Computational Techniques, Salt Lake City, Utah, August 11-12, **2009.**
66. M. H. Al-Dahhan, Abdul Rahman Mohsen, Solids and Gas Dynamics of Pebble Bed Reactors, DOE-NERI review meeting, Salt Lake City, Utah, August 11-12, **2009.**
65. M. H. Al-Dahhan, Applications of Radioisotopes Based Techniques in Industrial Processes Including 4th Generation Nuclear Energy, Korea Atomic Energy Research Institute, South Korea, July 8, **2009.**
64. M. H. Al-Dahhan, Development of International Partnerships and Consortium, Ministry of Science and Technology, Iraq, June 25, **2009.**
63. M. H. Al-Dahhan, An Overview of Clean Alternative energy, College of Engineering, University of al-Qadysia, Iraq, June 21, **2009.**
62. M.H. Al-Dahhan, Radioisotopes application in industry, Nuclear Engineering Department, Missouri S&T, April 27, **2009.**
61. M.H. Al-Dahhan, N. Rados, A. Shaikh, L. Han, C. Wu, A. Youssef, M. Hamed, Advances of Synthesis Gas Conversion into Clean Alternative Fuels and Chemicals, System Engineering, Missouri S&T, April 1, **2009,**
60. M.H. Al-Dahhan, Multiphase reaction engineering for clean energy and environment, UiTM – University, Shah Alam, Malaysia, February 5, **2009.**
59. M.H. Al-Dahhan, Graduate studies and research in chemical engineering, UiTM – University, Shah Alam, Malaysia, February 2-6, **2009.**

58. M.H., Al-Dahhan, ABET requirements implementation for chemical engineering programs, UiTM – University, Shah Alam, Malaysia, February 2-6, **2009.**
57. M.H. Al-Dahhan, Computing and computer applications in chemical engineering undergraduate curriculum, UiTM – University, Shah Alam, Malaysia, February 4, **2009.**
56. M.H. Al-Dahhan, Integrating Hydrodynamics and Transport with Kinetics for Proper and Efficient Design, Scale-up and Performance Prediction: Example of Trickle Bed Reactors (TBR) for Clean Fuels and Environmental Applications, Chemistry department, Missouri S&T, March 2, **2009.**
55. M.H. Al-Dahhan, R. Varma, M. Vesvikar, K. Karim, R. Hoffman, D. DePaoli, K. Klasson, A. Winterberg, C. Alexander, Bio-energy production from anaerobic digestion of animal and farm wastes, Energy Summit, University of Missouri Systems, Columbia, MO, April 22-23, **2009**
54. M.H. Al-Dahhan, How can we help higher education in Iraq, Iraqi Academics conference – US national academies, Washington D.C., March 14-15**, 2009.**
53, M.H. Al-Dahhan, Clean and energy efficient coal utilization, Board of Trustees, Missouri S&T, Rolla, April 3, **2009**.
52. M.H. Al-Dahhan, Luo, H.-P., Novel modeling approach of microalgae culturing in photo bioreactors for renewable energy, NSF – CEBC (Center for Environmental Beneficial Catalysis) Colloquium, November 20, **2008.**
51. Al-Dahhan, M.H. , Yablonsky, G.S.; Gleaves, J.T.; Zheng, X.; Feres, R. , Process development from molecular scale, catalyst design to process reactor scales: how and what are the needs, Kuwait Institute of Scientific Research (KISR), Petroleum research center, Kuwait, December, **2008.**
50. M. H. Al-Dahhan, Recent Advances and Scale-up of Trickle Bed Reactors (TBR) for Clean Fuels and Environmental Applications - Scale-up and design issues of multiphase Packed Bed Reactors for petroleum processing, Kuwait Institute of Scientific Research (KISR), Petroleum research center, Kuwait, December, **2008.**
49. Muthanna Al-Dahhan, Rajneesh Varma, Mehul Vesvikar and Ashfaq Shaikh, Advanced Radiometric Measurement Techniques for Industrial Multiphase Flow Systems: Dual Source Gamma Ray Computed Tomography (DSCT), Multiple Radioactive Particles Tracking (MRPT) & Nuclear Gauge Densitometry (NGD) Techniques, International Atomic Energy Agency, IAEA, Vienna, October 14, **2008.**
48. M.H. Al-Dahhan, Advancing the knowledge and understanding of multiphase reactors via advanced measurement techniques, Wuhan Institute of Chemical Technology, Wuhan, China, July, **2008.**
47. Muthanna Al-Dahhan, Educational Approaches for Bio-Processes and The Needed Advanced measurement Techniques for Their Efficient Design and Scale-up: What are the needs, International Conference on Yeast, ICY-2008, Kiev, Ukraine, August 11-15, **2008.**
46. M.H. Al-Dahhan, Imaging and visualization techniques for multiphase flow systems, Beijing University of Chemical Technology, July, **2008.**
45. M.H. Al-Dahhan, Luo, H.-P., Culturing microalgae in photo bioreactors, Missouri University of Science and Technology, Rolla, July 10, **2008.**
44. M.H. Al-Dahhan, Multiphase reactors for clean energy, TU Dortmund-University, Germany, June, **2008.**
43. M.H. Al-Dahhan, Scale-up issues on multiphase reactors, Bayer, Germany, June, **2008.**
42. M.H. Al-Dahhan, A. Youssef, F. Ahmed, R. Abdulmohsin, Advancement of slurry bubble columns for clean alternative fuels, Jonson Matthey Catalyst, May 29, **2008.**
41. M. H. Al-Dahhan, Advanced radiometric techniques to visualize multiphase flow systems, Nuclear Malaysia Agency, May 14, **2008**.
40. M. H. Al-Dahhan, Advancing the design and scale-up of multiphase packed bed reactors, National University of Malaysia, May 22, **2008**.
39. M.H. Al-Dahhan, Luo, H.-P., Culturing microalgae for CO_2 fixation, gas Treatment and renewable energy, Center Ethanol, February **2008.**
38. Al-Dahhan M., **(2007)** Advancement of trickle bed reactors scale-up and design for clean fuels production, Indian Oil R&D Center, December, Faridabad, India.
37. Henriques, A., Johnston, D., and Al-Dahhan, M., Enzymatic water removal from distillers grains. Southern Illinois University. SIUE: Edwardsville, IL, **(2007)**.

36. Henriques, A., Johnston, D., and Al-Dahhan, M., **(2007)** Energy efficient bioethanol and distillers grains process, Center Ethanol, LLC: Sauget, IL.
35. S. Antal, R. Lahey, M. H. Al-Dahhan, **(2007)** Capabilities of mechanistic closures in prediction the hydrodynamics of bubble/slurry bubble columns using CFD-NPHASE code, IBCAST – 2007, January 8-12, Pakistan.
34. Vaishali, S., Shantanu Roy, Satish Bhusarapue, **(2007)** M.H. Al-Dahhan, M.P. Dudukovic, CFD in gas-solid riser, IBCAST – 2007, January 8-12, Pakistan.
33. K. Karim, G. J. Thoma, M. H. Al-Dahhan, **(2007)** Gas-lift anaerobic digester configuration effects on mixing effectiveness for biogas production , IBCAST – 2007, January 8-12, Pakistan.
32. Muthanna Al-Dahhan, **(2007)** Advancement made slurry bubble column reactors for clean alternative energy production, Idaho National Laboratory, April 19.
31. Al-Dahhan, M. H., **(2006)** Advances in FT Reactor Technology for Alternative Energy and Chemical Production: Dynamic Similarity via Advanced Diagnostic Techniques. Invited Lecture, University of Dresden, Dresden, Germany, October 18.
30. Al-Dahhan, M.H., **(2006)** Advancement in Multiphase Reactors via Advanced Measurement Techniques, Invited Lecture, MINT – Malaysian Institute on Nuclear Technology, August, 31.
29. Al-Dahhan M., Luo H., **(2005)** A novel integrated multi-scale model for the prediction of culturing microalgae in photo bioreactors for renewable energy, December, Chemical Engineering Department, IIT Delhi, India.
28. Al-Dahhan M, **(2005)**, Advancement in multiphase reactors via non-invasive measurement techniques, Indian Oil R&D Center, December, Faridabad, India.
27. Antal, S.P., R. T. Lahey, M. H. Al-Dahhan, (**2005**). Computational Fluid Dynamics Modeling of A Bubble Column with NPHASE Computer Code. 4th International Bhurban Conference on Applied Science and Technology (IBCAST), Bhurban, Pakistan, June 12-18.
26. Mehul, S.V., M.H. Al-Dahhan, (**2005**). Anaerobic Digester Design using CFD. 4th International Bhurban Conference on Applied Science and Technology (IBCAST), Bhurban, Pakistan, June 12-18.
25. Rafique, M, M.H. Al-Dahhan, M. P. Dudukovic, (**2005**). Influence of Different Closures on Hydrodynamics of Bubble Column Flows, 4th International Bhurban Conference on Applied Science and Technology (IBCAST), Bhurban, Pakistan, June 12-18.
24. M. H. Al-Dahhan, **(2005).** Advances in Multiphase Reactors, Award Ceremony, Big Fish Award, Association of Graduate Engineering Students (AGES), May 19.
23. M. H. Al-Dahhan, **(2005).** Advancement in Understanding Multiphase Reactors, Engineering School, University of Pretoria, Pretoria, South Africa, May 16.
22. M. H. Al-Dahhan, **(2005).** Flow dynamics visualization of opaque multiphase reactors by CARPT and CT, Imaging Science and Engineering Seminar, Department of Electrical and Computer Engineering, Washington University, St. Louis, MO, April 1.
21. Muthanna H. Al-Dahhan_and Hu-Ping Luo **(2004,.** An Example of Flow Pattern and Mixing in Bioreactors using Laboratory Tools, Process Development Symposium: Working Right on the Right, Chicago, June 20-23.
20. Al-Dahhan, M.H. **(2004).** A Novel Modeling Approach for Predictions of the Dynamic Growth of Microalgae in Multiphase Photo bioreactors, **Invited talk** in implementing Process Innovation, Biophex Conference and Expo- post discovery through commercialization, San Francisco, Sep. 28-30.
19. M. Al-Dahhan, **(2003)**. Opaque Multiphase Reactors: Flow visualization and Modeling, **Invited Talk**, 2003 AIChE Process Development Symposium, Accelerating process Development for Growth, Ponoco, PA, June 22-25.
18. M. Al-Dahhan, **(2003)** Fluid visualization and modeling of opaque multiphase flow reactor. *Invited Talk*, National Technical University, Athens, Greece, May-13.
17. M. H. Al-Dahhan, **(2003)** Flow visualization of opaque multiphase reactors. Sandia National Laboratory, Albuquerque, NM, October 2003.
16. M. H. Al-Dahhan **(2002)**. Recent advances in multiphase reactors, Oak Ridge National Laboratory, Oak Ridge, Tennessee, November 14.

15. M. H. Al-Dahhan **(2002)**. Dynamic growth of microalgae culture in photo bioreactors, Horizons in Biotechnology Forum, DuPont, June 7.
14. M. H. Al-Dahhan and M. P. Dudukovic, (**2002**). Multiphase Reactors: Is advanced modeling needed and possible, Aspen World 2002, Washington DC, October 27-November 1.
13. M. H. Al-Dahhan, **(2002).** Multiphase reactors in petroleum processes, Aramco, Dhahran, Saudi Arabia, December 17
12. M. H. Al-Dahhan, **(2002).** CFD modeling and flow characterization of multiphase flow systems, SABIC, Riyadh, Saudi Arabia, December 19.
11. M. H. Al-Dahhan, **(2002),** Recent advances in multiphase reactors, King Saud University, Riyadh, Saudi Arabia, December 19
10. M. P. Dudukovic' and M. H. Al-Dahhan (**2002**), Experimentation and Modeling of Multiphase Reactors, UOP, Chicago, November 25
9. M. P. Dudukovic' and M. H. Al-Dahhan (**2002**), Hydrodynamics of Multiphase Reactors, University of Southern Illinois, Carbondale, May 14
8. Muthanna Al-Dahhan, (**2001**) "Tomography and radioactive particle tracking techniques for multiphase reactors", Bayer Co., Germany, August 31
7. M. H. Al-Dahhan, A.R. Rammohan, P. Fongarland, S. Bhusarapu, M.P. Dudukovic, (**2001**) "Gas-solid riser flow mapping: effect of dynamic bias and sampling frequency on CARPT measurements", MFDRC (multiphase fluid dynamic research consortium) review meeting, NETL (National Energy Technology Laboratory), Morgantown, WV, April 17-18.
6. Muthanna H. Al-Dahhan, (**2000**) "Slurry bubble column hydrodynamics", Praxair Inc., New York, March 7.
5. S. Roy, R. Dodson, F. Larachi, M.H. Al-Dahhan, M.P. Dudukovic, (**1999**) "Flow mapping in a gas-solid riser via computer automated radioactive particle tracking", 1999 Annual Meeting of the Multiphase Fluid Dynamics Research Consortium (MFDRC), Mendenhall, Pennsylvania, September 26-28.
4. M.H. Al-Dahhan, M.P. Dudukovic, **(1998)** "Scale-up in reaction engineering" Invited Lecture, 307a, AIChE Annual Meeting, Miami Beach, Florida, November 15-20.
3. Muthanna H. Al-Dahhan, (**1998**) "Multiphase reactors", Rose-Hulman Institute of Technology, April.
2. Muthanna H. Al-Dahhan, (**1995**) "Catalyst wetting efficiency in trickle-bed reactors with/without fines", Chemical Engineering Department, University of Missouri - Columbia, March.
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357. Neven Yousif Ali, Thaar Mohammad Al-Juwaya, Muthanna Al-Dahhan **(2013)** Effects of operating and design variables on the phases' distribution using Gamma Ray Computed Tomography (CT) of spouted beds, 2013 American Nuclear Society Winter Meeting and Nuclear Technology Expo, Washington, DC, November 10-14, 2013
356. Vaibhav Khane, Muthanna H. Al-Dahhan **(2013)** Experimental and Computational Study of Slow and Dense Granular Flow in a Pebble Bed Reactor, 8980, 2013 American Nuclear Society Winter Meeting and Nuclear Technology Expo, Washington, DC, November 10-14, 2013
355. Khairul Anuar Mohd Salleh, Hyoung Koo Lee, Muthanna H. Al-Dahhan **(2013)**, New local liquid velocity measurement technique in Trickle Bed Reactors (TBRs) using X-ray Digital Industrial Radiography and Particle Tracking (DRPT) techniques, 9444, 2013 American Nuclear Society Winter Meeting and Nuclear Technology Expo, Washington, DC, November 10-14, 2013
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350. Moses Kagumba and Muthanna H. Al-Dahhan **(2013)** Impact of Internals Size and Configuration on Bubble Dynamics in Bubble Columns, 2013 AIChE Annual Meeting, San Francisco, CA, November 3-8, 2013
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347. Aastha Ojha, Amer Zmat, Muthanna Al-Dahhan **(2013)** Study of Local Gas Holdup, and Specific Interfacial Area in a Split-Column Airlift Bioreactor for Culturing Microalgae/Cyanobacteria, 2013 AIChE Annual Meeting, San Francisco, CA, November 3-8, 2013
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345. Moses Kagumba and Muthanna H. Al-Dahhan **(2013)** Contact Time for Mechanistic Modeling of Heat Transfer Coefficient in Slurry Bubble Columns, 2013 AIChE Annual Meeting, San Francisco, CA, November 3-8, 2013
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341. Abdulmohsin, R., and Al-Dahhan, M., (**2012)**, Axial gas dispersion in the core of a pebble bed reactor for the 4th generation nuclear energy, 22nd International Symposium on Chemical Reaction Engineering (ISCRE 22), September 2-5, 2012 in Maastricht, the Netherlands.
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334. Vaibhav Khane, G.E. Mueller, and M.H. Al-Dahhan, **(2012)**, Parametric Sensitivity Study of Interaction Properties for Simulation of Realistic Packed Bed Structures, AIChE-2012 Annual Meeting, October 28-November 2, Pittsburg, PA.
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330. M. Al Mesfer, P. Neogi and M.H. Al-Dahhan, **(2012)**,Investigation of the Effect of Internals on Hydrodynamics in Bubble Column Reactors Using Computed Tomography (CT), AIChE-2012 Annual Meeting, October 28-November 2, Pittsburg, PA.
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328. Shreekanta Aradhya, Ghanim Alwan and M. H. Al-Dahhan, **(2012)**, Study of Solids and Gas Distribution in Spouted Bed Operated in Stable and Unstable Conditions, AIChE-2012 Annual Meeting, October 28-November 2, Pittsburg, PA.
327. Mehul Vesvikar, Muthanna Al-dahhan, **(2012),** Development, validation and implementation of multiple radioactive particle tracking (MRPT), 6th International Symposium on Process Tomography, Cape Town (South Africa), March 25-28
326. Fadha Ahmed, Mohammed Al-Mesfer, Muthanna Al-Dahhan, **(2012)**, Bed structure characterization of pebble bed reactor using gamma ray tomography, 6th International Symposium on Process Tomography, Cape Town (South Africa), March 25-28
325. P. A. S. Vasquez, R. Varma, M. M. Hamada, C. Henrique De Mesquita, M. H. Al-Dahhan, **(2012)**, Image reconstruction algorithms applied to polyenergetic gamma ray tomography for large systems, 6th International Symposium on Process Tomography, Cape Town (South Africa), March 25-28
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322. Shreekanta Aradhya, M. H. Al-Dahhan, **(2012)**, A New Methodology for Optical Probe Calibration and Validation with Computed Tomography in Spouted Beds, presented at 6th International Symposium on Process Tomography, Cape Town, South Africa, March 26-28
321. Khane, V., Mueller, G.E., Al-Dahhan M.H., **(2012)**, Study of Solids Dynamics in Moving Bed Reactor using Radioactive Particle Tracking (RPT) Technique, 6th International Symposium on Process Tomography, Cape Town, South Africa, March 26-28

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317. Vaibhav Khane, G.E. Mueller, and M.H. Al-Dahhan, **(2011)**, Continuation of Experts in Discrete Element Modeling (EDEM) Validation for Packed Bed Structural Properties, AIChE-2011 Annual Meeting, October 2011, Minnesota

316. Gahnim M. Alwan, Muthanna Al-Dahhan, **(2011)**, Simulation and multi-objective optimization of a continuous biochemical reactor using multilayer modeling technique, AIChE-2011 Annual Meeting, October 16-21, Minnesota

315. Gahnim M. Alwan, Muthanna Al-Dahhan, **(2011)**, Multi-objective optimization of autothermal catalytic membrane reactor using genetic algorithm, AIChE-2011 Annual Meeting, October 16-21, Minnesota

314. S. Nedeltchev, A. Shaikh, F. Ahmed and M. Al-Dahhan, **(2011)**, Combining Chaos Analysis, Information Entropy Theory and Radioactive Techniques for Flow Regime Identification in Both Bubble Columns and Fluidized Beds, Gas-Liquid and Gas-Liquid-Solid Reactor Engineering Congress (GLS10), Braga (Portugal), June 26-29

313. S. Nedeltchev, M. Kagumba and M. Al-Dahhan, **(2011)**, Flow Regime Identification in a Bubble Column with a Conically-Shaped Inlet Based On Optical Probe Data and Different Entropies, First International Symposium on Multi-scale Multiphase Process Engineering (MMPE), Kanazawa city, Ishikawa Prefecture (Japan), October 4-7

312. G. M. Alwan, S. Nedeltchev, S. Aradhya and M. Al-Dahhan, **(2011)**, Multi-objective Optimization of a Spouted Bed Reactor," 2011 AIChE Annual Meeting, Minneapolis, Minnesota (USA), October 16-21

311. S. Nedeltchev and M. Al-Dahhan, **(2011)**, Characterization of the Degree of Turbulence in Bubble Columns Based On Chaos Analysis of CARPT Data, 2011 AIChE Annual Meeting, Minneapolis, Minnesota (USA), October 16-21

310. Abdulmohsin, R., and Al-Dahhan, M., **(2011)**, Axial gas dispersion and heat transfer coefficient in a pebble bed reactor" ANS Winter Meeting and Nuclear Technology Expo, Oct.30th - Nov.3rd, 2011, Washington, DC, USA

309. Abdulmohsin, R., and Al-Dahhan, M., **(2011)**, Effect of pebble sizes on axial gas dispersion in a pebble bed" AIChE Annual Meeting, October 16-21, 2011 at Minneapolis, Minnesota, USA

308. Abdulmohsin, R., and Al-Dahhan, M., **(2011)**, Local time-averaged heat transfer coefficient in a pebble bed, AIChE Annual Meeting, October 16-21, 2011 at Minneapolis, Minnesota, USA

307. Abdulmohsin, R., and Al-Dahhan, M., **(2011)**, Axial gas dispersion in a pebble bed reactor: effect of pebble size, American Nuclear Society (ANS) Annual Meeting, June 26-30, 2011 at Hollywood, Florida, USA

306. Abdulmohsin, R., Ali, N. and Al-Dahhan, M., **(2011)**, Heat transfer coefficient in a pebble bed reactor (PBR)" ANS Annual Meeting, June 26-30, 2011 at Hollywood, Florida, USA

305. Abdulmohsin, R., Abid, B., and Al-Dahhan, M., **(2011)**, Effect of scale-up on the heat transfer coefficient and rate in bubble columns" AIChE Spring National Meeting and 7th Global Congress on Process Safety, March 13-17, 2011 at Chicago, Illinois, USA

304. Abdulmohsin, R., Naida, A., and Al-Dahhan, M., **(2011)**, Gas dynamics and heat transfer of pebble bed reactor (PBR) for the 4th generation nuclear energy, The Graduate Research Showcase, April 11, at Missouri S&T

303. Faraj Zaid, Stoyan Nedeltchev and Muthanna H. Al-Dahhan, **(2011)**, Regime Transitions in a Fluidized Bed Based On Analyses of Gauge Pressure Fluctuations, ANS Annual Meeting, Hollywood, Florida, June 26-30

302. S. Nedeltchev, S. Aradhya, F. Zaid and M. Al-Dahhan, **(2011)**, Flow Regime Identification in Both Spouted and Fluidized Beds Based on Different Entropies Derived from Gauge Pressure Fluctuations," First International Symposium on Multi-scale Multiphase Process Engineering (MMPE), Kanazawa city, Ishikawa Prefecture (Japan), October 4-7

301. Faraj Zaid, Stoyan Nedeltchev and Muthanna H. Al-Dahhan, **(2011)**, Investigation of the Effect of Fluidized Bed Scale On the Solid Dynamics Using Sophisticated Optical Probe, 2011 AIChE Annual Meeting) Minneapolis, MN October 16-21

300. Faraj Zaid, Stoyan Nedeltchev and Muthanna H. Al-Dahhan, **(2011)**, Flow regime Identification In Fluidized Beds Based on Statistical Analysis of Both Pressure Fluctuations and Optical Probe Data, 2011 AIChE Annual Meeting) Minneapolis, MN, October 16-21

299. S. Nedeltchev, S. Aradhya, F. Zaid and M. Al-Dahhan, **(2011),** Flow Regime Identification in Different Two-Phase Reactors Based on Extraction of Various Entropies from Gauge Pressure Fluctuations, 2011 AIChE Annual Meeting, Minneapolis, Minnesota (USA), October 16-21

298. S. Aradhya, X. Lan, M. H. Al-Dahhan, **(2011)**, CFD Evaluation for Different Match and Mismatch Conditions for operating Spouted Beds, presented at ANS Winter Meeting, Las Vegas, Nevada, Nov. 7-11

297. S. Aradhya, X. Lan, M. H. Al-Dahhan, **(2011)**, Assessing the Scale-up Methodology Based on Dimensional Analysis for Spouted Beds – a Comparison between Optical Probes and CFD, presented at ANS Annual Meeting, Hollywood, Florida, Jun. 26-30

296. S. Nedeltchev, S. Aradhya, F. Zaid, M. H. Al-Dahhan, **(2011)**, Flow Regime Identification in Both Spouted and Fluidized Beds Based on Different Entropies Derived from Gauge Pressure Fluctuations", accepted at 1st International Symposium on Multi-scale Multiphase Process Engineering (MMPE), Kanazawa, Japan, Oct. 4-7

295. S. Aradhya, M. H. Al-Dahhan, **(2011)**, Comparative Study of Spouted Bed Hydrodynamics Based on Dimensionless Approach using Optical Probes and CFD, AIChE Annual Meeting, Minneapolis, MN, Oct. 16-21

294. S. Aradhya, M. H. Al-Dahhan, **(2011)**, Study of Effect of Design and Operating Conditions on Spouted Bed Hydrodynamics, AIChE Annual Meeting, Minneapolis, MN, Oct. 16-21

293. Rao V.M., Abdulghani A.J, Rojas J.V., Al-Dahhan M., Toshkov S., Castano C.H., **(2011)**, Multi-walled Carbon Nanotubes Decorated with Va and Ni by Gamma Irradiation, Materials Science & Technology, Columbus, Ohio, October 2011

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287. Abdulmohsin, R., Abid, B., and Al-Dahhan, M. **(2011)** Effect of scale-up on the heat transfer coefficient and rate in bubble columns, AIChE Spring National Meeting and 7th Global Congress on Process Safety, March 13-17, at Chicago, IL

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285. Abdulmohsin, R., Khane, V., O'Bryant, K., Hallier, P. and Al-Dahhan, M., **(2010)**, Solids and gas dynamics of pebble bed reactor (PBR) for the 4th generation nuclear energy" The Graduate Research Showcase, April 12, at Missouri S&T

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283. Xingying Lan, Shrekanta Aradhya, Muthanna Al-Dahhan, **(2010)** CFD evaluation of the dimensionless groups approach for spouted beds scale-up, paper 97g, Session 97 - Fundamentals of Fluidization - II, AIChE-2010 Annual Meeting, November 2010, Salt Lake City, Utah

282. Shrekanta Aradhya, Muthanna Al-Dahhan, **(2010)** Implementation of new optical probe in spouted bed to assess the dimensional analysis based scale-up methodology, paper 478g, Session 478 - Multiphase Reaction Engineering, AIChE-2010 Annual Meeting Conference, November 7-12, at Salt Lake City, UT

281. Ahmed, Fadha, Shrekanta Aradhya, Muthanna Al-Dahhan, **(2010)** Feasibility study of flow regime identification in a fluidized bed using gamma ray densitometry technique, paper 384e, Session 384 - Applications of Fluidization, AIChE-2010 Annual Meeting, November 2010, Salt Lake City, Utah

280. Abdulmohsin, R., and Al-Dahhan, M., **(2010)**, Impact of internals on the heat transfer rate and coefficient in a bubble column, paper 478e, Session 478 - Multiphase Reaction Engineering, AIChE-2010 Annual Meeting Conference, November 7-12, at Salt Lake City, UT.

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278. Xingying Lan, Muthanna Al-Dahhan, **(2010)** CFD evaluation for dimensionless groups approach for spouted beds scale-up, Session on Experimental and CFD analysis of Gen-IV reactors, ANS Winter Meeting and Nuclear Technology Expo, November 7-11, 2010 at Las Vegas, NV

277. Vaibhav Khane, G.E. Mueller, and M.H. Al-Dahhan, **(2010)** Experts in Discrete Element Modeling (EDEM) Validation for Packed Bed Structural Properties, paper 676c, Session 676 - Advances in Numerical Simulations Bridging Chemical and Nuclear Engineering Phenomena or Processes, AIChE-2010 Annual Meeting, November 2010, Salt Lake City, Utah.

276. Vaibhav Khane, Rahman Abdul Mohsen, M.H. Al-Dahhan, **(2010)** Study of Solids Dynamics in PBR using Radioactive Particle Tracking Technique, American Nuclear Society (ANS) Winter Meeting November 2010, Las Vegas, Nevada

275. Nedeltchev, S.; Fadha Ahmed; Muthanna Al-Dahhan, **(2010)** Identification of main transition velocities in an air-polyethylene fluidized bed based on chaos analysis of computed tomographic scans, paper 478f, session 478 - Multiphase Reaction Engineering, AIChE-2010 Annual Meeting, November 2010, Salt Lake City, Utah

274. Nedeltchev, S.; Shaikh, A., and Al-Dahhan, M. H. **(2010)**, Flow regime transition in bubble columns using Nuclear Gauge Densitometry: Application of non-linear chaos analysis to photon counts history. International Symposium on Chemical Reaction Engineering (ISCRE 21), Philadelphia, PA, USA

273. Mohamed Ezat Hamad and Muthanna Al-Dahhan **(2009)**, Mass transfer in bubble columns with internals, Gas-Liquid and Gas-Liquid-Solid Reactor Engineering Session (GLS 9), 8th World Congress of Chemical Engineering, Montreal, Canada

272. Shaikh A. and Al-Dahhan, M. H. **(2009)**, A New Methodology for Hydrodynamic Similarity in Bubble Column Reactors. Gas-Liquid and Gas-Liquid-Solid Reactor Engineering Session (GLS 9), 8th World Congress of Chemical Engineering, Montreal, Canada.

271. Nedeltchev, S.; Shaikh A. and Al-Dahhan, M. H. **(2009),** Application of Chaos Theory to CT Data: Identification of Transition Velocities in Bubble Columns.. Gas-Liquid and Gas-Liquid-Solid Reactor Engineering (GLS 9), 8th World Congress of Chemical Engineering, Montreal, Canada.

270. Shaikh A. and Al-Dahhan, M. H. **(2009),** Online Flow Regime Monitoring in Bubble Column Reactors via Nuclear Gauge Densitometry. Gas-Liquid and Gas-Liquid-Solid Reactor Engineering Session (GLS 9), 8th World Congress of Chemical Engineering, Montreal, Canada.
269. Youssef, A., Dudukovic, M. P., Al-Dahhan, M. H. **(2009)**, Novel scale-up methodology for bubble column reactors, GLS 9 (part of the 8th World Congress of Chemical Engineering) Montreal, Canada, August 23-28.
268. Youssef, A., Dudukovic, M., Al-Dahhan, M. **(2009),** On the hydrodynamics of bubble columns with internals for liquid fuels syntheses, AIChE Spring National Meeting, Tampa, Florida, April 26-30, 2009.
267. A. Abdulmohsin, Muthanna Al-Dahhan, M. Morali, **(2009)** Solids dynamics of high temperature pebble bed nuclear reactors, Energy Summit, University of Missouri System, April, 22-23, Columbia, Missouri.
266. Shrekanta Aradhya, Muthanna Al-Dahhan, V. Harvan, **(2009)** Solids flow dynamics of spouted beds for production of nuclear fuel particles for pebble bed reactors, Energy Summit, University of Missouri System, April, 22-23, Columbia, Missouri.
265. M. Ezat Hamed Awad, Muthanna Al-Dahhan, **(2009)** Mixing characteristic on bubble columns for BTL (biomass to liquid fuels), Energy Summit, University of Missouri System, April, 22-23, Columbia, Missouri.
264. A. Youssef, M.P. Dudukovic, Muthanna Al-Dahhan **(2009),** A new design and scale methodology for bubble columns for BTL, Energy Summit, University of Missouri System, April, 22-23, Columbia, Missouri.
263. Mohamed Hamed Ezat Awad, Muthanna Al-Dahhan, **(2009)** Mixing characteristics of bubble columns with internals for biomass to liquid fuels and chemicals synthesis, Bio-Energy II: Fuels and chemicals from renewable resources, March 9-13, Rio de Janeiro, Brazil.
262. Ahmed Youssef, Muthanna Al-Dahhan, M.P. Dudukovic, **(2009)** Novel design of multiphase reactors for biomass-to-liquid (BTL) conversion, Bio-Energy II: Fuels and chemicals from renewable resources, March 9-13, Rio de Janeiro, Brazil.
261. Rajneesh Varma, Muthanna Al-Dahhan, **(2009)** Optimization of biogas production for maximum energy output from anaerobic digestions, Bio-Energy II: Fuels and chemicals from renewable resources, March 9-13, Rio de Janeiro, Brazil.
260. Hu-Ping Luo, Muthanna Al-Dahhan, **(2009)** Bioenergy production from microalgae culturing, Bio-Energy II: Fuels and chemicals from renewable resources, March 9-13, Rio de Janeiro, Brazil.
259. Sean G. Mueller, Muthanna H. Al-Dahhan, Milorad P. Dudukovic, **(2008)** "In-Situ, Fiber-Optic Measurement Techniques in Carbon Dioxide Expanded Liquid (CXL) Multiphase Reactors", Presentation at the 2008 AIChE Conference, New Orleans, Division 20, Session 172, 2008.
258. Ahmed Youssef, Muthanna Al-Dahhan, M.P. Dudukovic, **(2008)** Novel reactor design for clean alternative fuels synthesis, Energy and Environment Summit, McDonnell International Scholar Academy, Hong Kong, December 8-10, 2008.
257. Sara Torkumani, Vesna Havran, Muthanna Al-Dahhan **(2008)** CFD of gas-solid spouted beds for nuclear fuel particles production for the next generation nuclear energy, US-India energy and sustainability symposium, Chandigarh, India, December 28-30.
256. Vesna Havran, Derek Starkey, Josh Grims Sean Mueller, Fadha Ahmed, Muthanna Al-Dahhan **(2008)** Hydrodynamics of the TRISO Nuclear fuel spouted bed coaters using optical probe and Gamma Ray Computed Tomography, International Symposium on Spouted Beds, ISSB – 2008, July 21-23, Beijing, China.
255. Bia Henriques, Fan Mei, Khursheed Karim, Steve Picker, Muthanna Al-Dahhan, **(2008)** A Bioenergy-Based Bench-Scale Experiment for Undergraduate Engineering Students, International conference on Yeast, ICY – 2008, August 11-15, Kiev, Ukraine.
254. Rajneesh Varma and Muthanna Al-Dahhan, **(2008)** A novel dual source Computed Tomography Technique For Measuring Phases Holdup Distribution In Multiphase Systems , 7th International Topical Meeting on Industrial Radiation and Radioisotope Measurement Application, IRRMA 7, 22-27 June, Prague, Czech Republic.

253. Ashfaq Shaikh, Muthanna Al-Dahhan, **(2008)** Novel flow regime determination methods in bubble columns operated for clean alternative energy using gamma ray based techniques, IRRMA7, June 22-27, Prague, Czech Republic.
252. Muthanna Al-Dahhan, Huping Luo, Culturing Microalgae in closed Photo bioreactors, **(2008)** Cell Culture Engineering, Engineering Conference International, April 14-18, Brisbane, Australia
251. Vesna Havran, Derek Starkey, Josh Grims, Sean Mueller, Fadha Ahmed, Muthanna Al-Dahhan, **(2008)** Investigations of solids and gas holdups of pouted beds using optical probes, XVIII International Conference on Chemical Reactors, September 29 to October 3, Malta.
250. Vaishali S., Shantanu Roy, Satish Bhusarapu, M. H. Al-Dahhan, M. P. Dudukovic, **(2007)** Numerical simulation of gas-solid dynamics in a circulating fluidized bed riser with Geldart group B particles, Camure-6 and ISMR-5 conference. 14-17 January, Pune, India.
249. Lu Han, Muthanna Al-Dahhan, (2007), Solids axial dispersion and distribution in a slurry bubble column reactor, 2nd North America Symposium on Chemical Reaction Engineering, February, Houston, TX,
248. Tobias Bauer, Stefan Haase, Muthanna Al-Dahhan, Ruediger Lange, **(2007)** Monolithic reactor and particle-packed monolithic reactor for three-phase catalytic reactions", AIChE Annual Meeting, Salt Lake City, Utah, Nov. 4-9, Session – Structure Catalytic Reactors: Monoliths and Membranes, 539d.
247. Muthanna Al-Dahhan, **(2007)** Summer Research for High School Students, AIChE Annual Meeting, Salt Lake City, Utah, Nov. 4-9, Session: Chemical Engineering Recruitment and Retention: K-13, 462e.
246. Rajneesh Varma, Mehul Vesvikar, Muthanna Al-Dahhan, **(2007)** Effect of mixing on the performance of a pilot scale anaerobic biodigester", AIChE Annual Meeting, Salt Lake City, Utah, Nov. 4-9, Session: Biotechnology and Bioengineering: Mixing Problems and Solutions, 71e.
245. Zeljko Kuzeljevic, Werner Vander Merwe, Milorad P. Dudukovic, Muthanna Al-Dahhan, **(2007)** Hysteresis in high pressure trickle bed reaction, AIChE Annual Meeting, Salt Lake City, Utah, Nov. 4-9, 2007, Session: Multiphase Reaction Engineering, 38b.
244. Rajneesh Varma, Joseph A. O'Sullivan, Muthanna Al-Dahhan, **(2007)** Dual source computed tomography for measuring phase holdup distribution in multiphase systems", AIChE Annual Meeting, Salt Lake City, Utah, Nov. 4-9, Session: Novel Computational and Experimental Methods in Multiphase Mixing, 601b.
243. R. Varma, J.A. O'Sullivan, M.H. Al-Dahhan, **(2007)** Application of alternating minimization (CAM) in dual source gamma ray computer tomography for imaging three phase systems, 5th World Congress on Industrial Process Tomography, September 3-6, Bergen, Norway.
242. A. Shaikh, M.H. Al-Dahhan, **(2007)** On-line flow regime monitoring in bubble columns via nuclear gauge densitometry, 5th World Congress on Industrial Process Tomography, September 3-6, Bergen, Norway.
241. Henriques, A., Johnston, D., and Al-Dahhan, M., **(2007)** Enzymatic water removal from distillers grains. Abst. 233rd American Chemical Society Annual Conference. ACS: Chicago, IL.
240. Henriques, A., Johnston, D., and Al-Dahhan, M., **(2007)** Enzymatic water removal from distillers grains. Poster. 2007 Annual Fuel Ethanol Workshop. FEW: St. Louis, MO.
239. Ashfaq Shaikh, Muthanna Al-Dahhan, **(2007)** Online flow regime monitoring in bubble columns via nuclear gauge densitometry, GLS 8, December 16-19, New Delhi, India.
238. Chengtian Wu, Muthanna Al-Dahhan, **(2007)** Heat transfer coefficient in high pressure slurry bubble column, GLS 8, December 16-19, New Delhi India
237. Henriques A., Rajneesh Varma, M. Vesvikar, K. Karim, R. Hoffman, Huping Luo, A. Shaikh, Lu Han, Chengtian Wu, Muthanna Al-Dahhan, **(2007)** Bioenergy from Biomass, Washington University Energy and Environment Symposium, May 5.
236. Bauer, T. Haase, S., Al-Dahhan, M., Lange, R., **(2007)** Hydrodynamics and performance studies in a minichannel and monolith reactor with & without particles. 8th International Conference on Gas-Liquid and Gas-Liquid-Solid Reactor Engineering (GLS 8), December 16-19, New Delhi, India.
235. Chengtian Wu and M. H. Al-Dahhan, **(2007)** Characterizing Bubble dynamics in a slurry bubble column using an advanced measurement technique. Industrial Symposium on Advances in Hydroprocessing of Oil Fractions (ISAHOF), Michoacan, Mexico, June 26-29.

234. S. Nedeltchev, A. Shaikh, and Muthanna Al-Dahhan, **(2006),** Identification of flow regime transition in a bubble column based on chaos analysis of gamma-ray computed tomography data, 7th German-Japanese Symposium on Bubble Columns, Goslar (Germany), May 20-23, 2006.
233. Shaikh A.; Han, L.; Rados, N.; and Al-Dahhan, M. H., **(2006)** Hydrodynamics of slurry bubble column reactors. Presented at APCChE06-11th Asian pacific confederation of chemical engineering, Kuala Lumpur, Malaysia, August
232. Varma R., Al-Dahhan M.H., **(2006)** Dual Source Gamma Ray Computer Tomography for Imaging Three Phase Systems . 15th September 2006. AIChE San Francisco, CA, Nov. 16.
231. Lu Han; Muthanna Al-Dahhan, **(2006)** A new methodology to measure the solids dispersion in high pressure slurry bubble column reactor. Oral presentation (294f). AIChE annual meeting, San Francisco, CA, Nov. 16.
230. Mehul, Vesvikar, Muthanna Al-Dahhan, **(2006)** Hydrodynamics and performance of laboratory and pilot plant scale anaerobic digesters, Presented at APCChE06-11th Asian pacific confederation of chemical engineering, Kuala Lumpur, Malaysia, August.
229. Bauer, T., Schubert, M., Al-Dahhan, M., Henning, T., Brandner J.J., Lange, R., **(2006)**, Visualization and Characterization of Gas-Liquid Two-Phase Flow in Minichannels. 19th International Symposium on Chemical Reaction Engineering (ISCRE19), Potsdam, Germany.
228. Schubert, M., Bauer, T., Al-Dahhan, M Lange, R., **(2006)** Experimental Comparison of Trickle Bed Reactor and Monolith Reactor at High Pressure, 19th International Symposium on Chemical Reaction Engineering (ISCRE19), Potsdam, Germany.
227. Lu Han, Muthanna Al-Dahhan, **(2006),** A new methodology to determine true tracer response in bubble and slurry bubble column using radioactive particle tracking data, 19th International Symposium on Chemical Reaction Engineering (ISCRE19), Potsdam, Germany.
226. Chengtian Wu and Muthanna H. Al-Dahhan, **(2006)** Bubble Dynamics Study in a Slurry Bubble Column with a Four-Point Optical Probe. AIChE meeting, San Francisco, CA, Nov. 16.
225. Subramanya Nayak, Kening Gong, Bala Subramaniam, Aldahhan Muthanna, M. P. Dudukovic, **(2006)** Estimation of Transport and Equilibrium Parameters on Beta-Zeolites - Tracer Experiments on Packed Bed Reactor Systems, AIChE meeting, San Francisco, CA, Nov. 16.
224. Guo J., David K., Al-Dahhan M., **(2006)** A Client-Server Architecture for Distributed Control and Measurement systems, 9th International Conference on Engineering Education, T1E-18-29, San Juan, PR.
223. M. Al-Dahhan, C. Carpenter, N. Nissing, **(2006)** Integrating Practice into Engineering Education-The Role of Adjunct Faculty and Industrial Mentor Program, T130-34, 9th International Conference on Engineering Education, T1E-18-29, San Juan, PR.
222. Mehul Vesvikar, Muthanna Al-Dahhan, **(2006)** Effect of Mixing and scale on the performance and hydrodynamics of anaerobic digesters, Bioenergy I, Tomar, Portugal, March 5-10.
221. Rajneesh Varma, Muthanna Al-Dahhan, **(2006)** Effect of Sparger on the hydrodynamics of anaerobic digester mixed by gas recirculation using advanced measurement technique, Bioenergy I, Tomar, Portugal, March 5-10.
220. Bhusarapu S., Cassanello M., Al-Dahhan M., Dudukovic M.P., Trujillo S., O'Hern T.J., **(2006)** Solids dynamics in gas-solid risers inferred from CARPT experiments, 5th World Congress on Particle Technology, Orlando.
219. Hoffmann R., Vesvikar M., Varma R., Karim K., Al-Dahhan M., Angenant L., **(2005)** Effect of shear on performance and microbial community in anaerobic digesters treating cow manure, Animal and Agriculture processing: Managing Environmental Impacts Conference, St. Louis, MO, August 31-September 2, Air and Waste Management Association and Water Environment Federation.
218. Jing Guo and Muthanna Al-Dahhan, "Catalytic wet oxidation over pillared clay catalyst in packed bed reactors: Experimentation and modeling", CHEMCON-2005, 58th Annual Congress of Indian Chemical Engineering, IIT- New Delhi, December 14-17, 2005.
217. M. Rafique, M.H. Al-Dahhan, M.P. Dudukovic, "Effect of different interfacial closures on the dynamics of bubble-column flows, IBCAST, 2005, Pakistan.
216. Mehul Vesvikar and Muthanna Al-Dahhan, "Effect of mixing on the performance of a pilot-scale anaerobic digester", Mid-America Environmental Engineering Conference, September 23-24, 2005.

215. Lu Han and Muthanna Al-Dahhan, "Axial dispersion of gas phase in slurry bubble column reactor", 2005 AIChE Annual Meeting, October 30 – November 4, Cincinnati, OH, 2005. Session: Solid-Liquid, Liquid-Liquid and Gas Mixing.
214. Mehul Vesvikar, Abhijeet Borole, Thomas Klasson, Khursheed Karim, Muthanna Al-Dahhan, David DePaoli, "Performance of a pilot scale digester and comparison with laboratory scale units", 2005 AIChE Annual Meeting, October 30 – November 4, Cincinnati, OH, 2005. Session: Chemicals From Waste Biomass.
213. Shaibal Roy and Muthanna Al-Dahhan, "Effects of flow maldistribution on multiphase monolith reactor performance", 2005 AIChE Annual Meeting, October 30 – November 4, Cincinnati, OH, 2005. Session: Structural Catalytic Reactors: Monoliths and Membranes.
212. M.P. Dudukovic and M.H. Al-Dahhan, "Why scale-up still matters", 2005 AIChE Annual Meeting, October 30 – November 4, Cincinnati, OH, 2005. Session: Rapid Process Scale-Up Through Unique Partnerships.
211. Ashfaq Shaikh and M.H. Al-Dahhan, "A new methodology for scale-up of bubble column reactors", 2005 AIChE Annual Meeting, October 30 – November 4, Cincinnati, OH, 2005. Session: Mixing Issues in Industrial Process I.
210. Chengtian Wu, M.H. Al-Dahhan, Anand Prakash, "Heat transfer coefficient measurements in high pressure bubble column", 2005 AIChE Annual Meeting, October 30 – November 4, Cincinnati, OH, 2005. Session: Multiphase Reaction Engineering.
209. Rajneesh Varma and Muthanna Al-Dahhan, "Hydrodynamic study of gas circulation aerobic bioreactors using particle tracking and gamma ray tomography" 2005 AIChE Annual Meeting, October 30 – November 4, Cincinnati, OH, 2005. Session: Upstream Bioprocessing.
208. Nayak Subramanya, Vidya Sagar Sarsan, Muthanna Al-Dahhan, Bala Subramaniam, Milorad Dudukovic, "Breakthrough curves for solid-acid catalyzed liquid-phase alkylation reactions", 2005 AIChE Annual Meeting, October 30 – November 4, Cincinnati, OH, 2005. Session: Liquid Phase Adsorption.
207. Henriques, B., Mei, F., Khursheed, K., Al-Dahhan, M., (**2005**). A Bioenergy Based Bench-Scale Experiment for Undergraduate Engineering Students. ACS 229th Annual Meeting, Green Chemical Education, San Diego, CA, March 13-18.
206. Henriques, B., Mei, F., Khursheed, K., Al-Dahhan, M. (**2005**). A Bioenergy Based Bench-Scale Experiment for Undergraduate Engineering Students. ASEE Annual Conference and Exposition, Portland, OR, June 12-15.
205. S. Bhusarapu, M. H. Al-Dahhan and M. P. Duduković, (**2005**). Flow Visualization of Gas-Solid Riser Circulating Fluidized Beds, **2005** AIChE Spring Meeting, Atlanta, Georgia, April 10-15.
204. Bhusarapu, S., M. H. Al-Dahhan and M. P. Duduković, (**2005**). Solids Flow Mapping in a Gas-Solid Riser: Mean Holdup and Velocity Fields, 7th World Congress of Chemical Engineering (WCCE7), Glasgow, United Kingdom, July 10-14.
203. Bauer, T., Guettel, R., Roy, S., Schubert, M., Al-Dahhan, M, Lange, R., (**2005**), Modelling and Simulation of the Monolithic Reactor for Gas-Liquid-Solid Reactions. 7th World Congress of Chemical Engineering (WCCE7), Glasgow, United Kingdom, July 10-14.
202. Xue J., M. H. Al-Dahhan, M. P. Dudukovic, R. Mudde, **(2005)**, Bubble dynamics in bubble columns, 7th World Congress of Chemical Engineering (WCCE7), Glasgow, United Kingdom, July 10-14.
201. S. Bhusarapu, M.H. Al-Dahhan, M.P. Duduković, (**2005**). An Alternating Minimization Algorithm for Image Reconstruction in Computed Tomography, the 4th World Congress on Industrial Process Tomography, Aizu, Japan, September 5-8.
200. Shaikh, A. and Al-Dahhan, M. H.; (**2005**). Identification of Flow Regime in Bubble Columns using Computed Tomography, accepted for Oral Presentation, 4th World Congress on Industrial Process Tomography , Aizu, Japan, September 5-8.
199. S. Roy and M.H. Al-Dahhan (**2005**), Flow Distribution in Monolith using Computed Tomography, the 4th World Congress on Industrial Tomography, Aizu, Japan, September 5-8
198. S. Roy and M.H. Al-Dahhan (**2005**), Flow Distribution in Monolith using Computed Tomography, the 2nd International Conference on Structured Catalysts and Reactors, Delft, the Netherlands, Oct. 16-19

197. S. Roy and M.H. Al-Dahhan **(2005)**, Effect of Flow Maldistribution on Multiphase Monolith Reactor Performance, the 2nd International Conference on Structured Catalysts and Reactors, Delft, the Netherlands, Oct. 16-19

196. M. H. Al-Dahhan, A. Kemoun, S. Roy, and A. R. Cartolano, R. Dobson, J. Williams, (**2005**) Study of gas-liquid distribution in a pilot plant monolith reactor using industrial tomography scanner (ITS) , 4th World Congress on Industrial Process Tomography , Aizu, Japan, September 5-8.

195. Lu Han, Muthanna Al-Dahhan. (**2005**). Volumetric Mass Transfer Coefficient in Bubble Column Reactors. 5th International Symposium on Multiphase Flow, Heat, Mass Transfer and Energy Conversion. Xi'an, China, 3-8 July.

194. Novica Rados, Ashfaq Shaikh, and Muthanna Al-Dahhan. (**2005**). Flow Visualization in High Pressure Slurry Bubble Columns via CARPT and CT. 5th International Symposium on Multiphase Flow, Heat Mass Transfer and Energy Conversion, Xi'an, China, 3-8 July

193. Chengtian Wu, Muthanna Al-Dahhan, (**2005**). Heat Transfer Coefficient Measurement in Bubble Column, 5th International Symposium on Multiphase Flow, Heat Mass transfer and Energy Conversion, Xi'an, China, 3-8 July.

192. N. Rados, A. Shaikh, M. H. Al-Dahhan (**2005**). Solids Flow Mapping in a High Pressure Slurry Bubble Columns, GLS 7 conference Strasbourg, France, August 21-25.

191. C. Boyer, A. Koudil, J. Guo, P. Chen, M. H. Al-Dahhan, M. P. Dudukovic', (**2005**). Study of liquid spreading from a point source in a Trickle Bed via gamma ray Tomography and CFD simulation, GLS7 conference Strasbourg, France, August 21-25.

190. Shaikh, A. and Al-Dahhan, M. H.; (**2005**). Characterization of Hydrodynamic Flow Regime in Bubble Columns via Computed Tomography, GLS 7 conference Strasbourg, France, August 21-25.

189. S. Roy and M. H. Al-Dahhan, (**2005**). Effect of flow maldistribution on multiphase monolith reactor performance, GLS 7 conference Strasbourg, France, August 21-25.

188. Bauer, T., Schubert, M., Al-Dahhan, M., Lange, R., (**2005)**, Hydrodynamics of the capillary microreactor. GLS 7 conference Strasbourg, France, August 21-25.

187. R. Hoffman, K. Karim, M. Vesvikar, M. H. Al-Dahhan, (**2005**). Effect of shear on performance and microbial community in anaerobic digesters treating cow manure. 5th International Chemical Engineering Conference, Amman, Jordan, September 12-14.

186. Jing Guo and M. H. Al-Dahhan, (**2005**). Catalytic wet oxidation over pillared clay catalyst in packed-bed reactors: experiments and modeling. 5th International Chemical Engineering Conference, Amman, Jordan, September 12-14.

185. Hu-Ping Luo and Muthanna H. Al-Dahhan (**2005**). A Novel Modeling Approach for Process Intensification of the Dynamic Growth of Microalgae in Multiphase Photo bioreactors, 5th International Chemical Engineering Conference, Amman, Jordan, September 12-14.

184. Bauer, T., Schubert, M., Al-Dahhan, M., Lange, R., (**2005)**, Performance evaluation of monolithic reactors for gas-liquid-solid reactions. 4h Asia-Pacific Conference on Chemical Reaction Engineering Symposium, Gyeongju, Korea.

183. Bauer, T., Guettel, R., Roy, S., Al-Dahhan, M, Lange, R., (**2005)**, Modeling of Monolithic Reactors for Catalyzed Gas-Liquid Reactions. 5th International Symposium on Catalysis in Multiphase Reactors (CAMURE-5) and 4th International Symposium on multifunctional Reactors, Portorose, Slovenia, June 15-18.

182. S. Bhusarapu, M. H. Al-Dahhan, M. P. Dudukovic', S. Trujillo, T. J. O'Hern, (**2005**). Experimental study of solids velocity field in gas-solid risers, 5th International Symposium on Catalysis in Multiphase Reactors (CAMURE-5) and 4th International Symposium on multifunctional Reactors (ISMR-5), Portorose, Slovenia, June 15-18.

181. J. Xue, M. H. Al-Dahhan, M. P. Dudukovic', R. F. Mudde (**2005**). Bubble velocity, size, and interfacial area measurements in bubble columns using four-point optical probe, 5th International Symposium on Catalysis in Multiphase Reactors (CAMURE-5) and 4th International Symposium on multifunctional Reactors, Portorose, Slovenia, June 15-18.

180. S. Roy and M. H. Al-Dahhan, (**2005**) Effect of flow distribution on the performance of gas-liquid monolith reactor, 5th International Symposium on Catalysis in Multiphase Reactors (CAMURE-5) and 4th International Symposium on multifunctional Reactors, Portorose, Slovenia, June 15-18.
179. Bauer, T., Schubert, M., Al-Dahhan, M., Lange, R., (**2005**) Hydrodynamics of single monolith channels. 2nd International Conference on Structured Catalysts and Reactors, Delft, Netherlands, October 16-19.
178. Shaikh, A.; Al-Dahhan, M. H.; (**2004**). Characterization of Hydrodynamic Flow Regime in Bubble Columns via Computed Tomography, AIChE Annual Meeting, Austin, USA, November 7-12.
177. S. Bhusarapu, M. H. Al-Dahhan and M. P. Duduković (**2004**). Solids Flow Mapping in a Gas-Solid Riser, AIChE Annual Meeting, Austin USA, November 7-12.
176. S. Bhusarapu, M. H. Al-Dahhan and M. P. Duduković (**2004**). Quantification of Solids Flow in a Gas-Solid Riser: Single Radioactive Particle Tracking, Oral Presentation, ISCRE 18, Chicago, USA, June 7-9.
175. S. Bhusarapu, M. H. Al-Dahhan and M. P. Duduković,(**2004**). Flow Visualization of Pilot-Plant Cold Flow FCC Unit via Advanced Non-Invasive Measurement Techniques, Oral Presentation, ISAHOF, Oaxaca, Mexico, April 18-22.
174. E. Palmasan, P.A. Ramachandran, K. Balakrishnan, M.H. Al-Dahhan, **(2004)** "Computation of effectiveness factors for partially wetted complex catalyst shapes using the method of fundamental solutions", ISAHOF 2004, Oaxacan, Mexico, April 18-22.
173. Rebecca Hoffmann, Khursheed Karim, Muthanna Al-Dahhan, Lars Angenent. (**2004**). Effect of Shear on Performance and Microbial Ecology in Anaerobic Digesters Treating Cow Manure. 9th Annual Mid-America Environmental Engineering Conference (MAEEC), Sept. 18, SIU-Edwardsville ($100 cash prize given by the district 8 branch of the American Public Works Association).
172. Vesvikar, M.S., Varma, R., Karim, K., Al-Dahhan, M.H. (**2004**) "Flow Pattern Visualization in a Mimic Anaerobic Digester: Experimental and Computational Studies." The 10th World Congress - Anaerobic Digestion 2004, Anaerobic Bioconversion for Sustainability, August 29th - September 2nd, Montreal, Canada.
171. S. P. Antal, R. L. Lahey, M. H. Al-Dahhan, (**2004**). Modeling churn-turbulent flows in a slurry/bubble column with a three field model of two-phase flow, 5th International Conference on Multiphase Flow (ICMF-2004), Yokohama, Japan, May 30-June 4.
170. Roy S.; Al-Dahhan, MH, (2004). Flow distribution in monolith using computed tomography, AIChE annual meeting, Austin, US, in honor of Mike Dudukovic', Oral Presentation, AIChE Annual Meeting, Austin, USA, November 7-12.
169. Bauer, T., Roy, S., Al-Dahhan, M., Lange, R., (**2004**), Holdups and Pressure Drop in Multiphase Monolithic Reactors. 18th International Symposium on Chemical Reaction Engineering (ISCRE 18), Chicago, USA, June 7-9.
168. Bauer, T., Roy, S., Schubert, M., Al-Dahhan, M., Lange, R., (**2004**), Investigation of Gas-Liquid Distribution in a Monolithic Reactor using Computed Tomography (CT). 16th International Congress of Chemical and Process Engineering (CHISA-16), Prague, Czech, August 22-26.
167. Guo, J. and Al-Dahhan, M. H. (2004), Liquid holdup and pressure drop in the gas-liquid co-current downflow packed-bed reactor under elevated pressures, ISCRE 18, Chicago, IL, USA, June 7-9.
166. Roy, S., Al-Dahhan, M. H., Dudukovic M. P., Skourlis, T., and Dautzenberg F.,(**2004**). Flow distribution in countercurrent flow structured packing bed via Computed Tomography (CT), ISAHOF, Oaxaca, Mexico, 18-22 April.
165. Hu-Ping Luo and Muthanna H. Al-Dahhan (**2004**). Local characteristics of hydrodynamics of in an internal loop airlift photo bioreactor-experimental and theoretical analysis, Oral Presentation, AIChE Annual Meeting, Austin, USA, November 7-12.
164. Guo, Jing, Al-Dahhan, M. H. (**2004**). Catalytic wet air oxidation of phenol on concurrent downflow and upflow packed bed reactors. Oral Presentation, AIChE Annual Meeting, Austin, USA, November 7-12.

163. Luo, H.-P. and Al-Dahhan, M.H.**,** (**2004**). A Novel Modeling Approach for Predictions of the Dynamic Growth of Microalgae in Multiphase Photo bioreactors, 12th International Biotechnology Symposium and Exhibition, Santiago, Chile, October 17-22.
162. Karim, K. and Muthanna Al-Dahhan, (**2004**). Evaluation of upflow anaerobic solids removal (UASR) digester for animal waste (Dairy Manure) digestion, 12th International Biotechnology Symposium and Exhibition, Santiago, Chile, October 17-22.
161. Al-Dahhan, Muthanna, Carpenter, Charles N., Nissing, Nick, (**2004**). Integrating practice into engineering education- the role of adjunct faculty and industrial mentor program, integrating practice into engineering program, Henry W. Patton Center for Engineering Education and Practice, University of Michigan, Dearborn, Michigan, October 3-5
160. Al-Dahhan, M.H., Luo, H.-P**.,** (**2003**). Local Characteristics of Flows in Airlift Photo-Bioreactors via CARPT experiments and CFD simulation, Computational Fluid Dynamics in Chemical Reaction Engineering III, Davos, Switzerland, May 25-30
159. Hu-Ping Luo and Muthanna H. Al-Dahhan (**2003**). Analyzing and Modeling of Photo bioreactors by Combining First Principles of Physiology and Hydrodynamics, 1th International Congress on Bioreactor Technology in Cell-, Tissue Culture and Biomedical Applications, Tampere, Finland July 14 – 18.
158. Hu-Ping Luo and Muthanna H. Al-Dahhan (**2003**). Flow characteristics of photo bioreactors, 1th International Congress on Bioreactor Technology in Cell-, Tissue Culture and Biomedical Applications, Tampere, Finland July 14 – 18.
157. M. Rafique, M. H. Al-Dahhan, M. P. Dudukovic', (**2003**). Influence of different closures on the hydrodynamics of bubble column flows, Computational Fluid Dynamics in Chemical Reaction Engineering III, Davos, Switzerland, May 25-30.
156. N. Dromard, O. Delsart, P. Spicka, M. H. Al-Dahhan, M. P. Dudukovic', D. Vedrine, J. Bousquet, C. Roger, (**2003**). Liquid distribution in trickle bed reactors: experimental and CFD modeling study. Oral Presentation, 4th Middle East Refining and Petrochemicals Conference and Exhibition, Manama, Bahrain, September 28- October 4.
155. M. H. Al-Dahhan, (**2003**). Non-invasive measurement techniques: CARPT and CT, lecture in a short course on industrial tomography, 3rd world Congress on Industrial Tomography, Banff, Canada, September 2-5.
154. Shaikh, A.; Rados, N.; Al-Dahhan, M. H.; (**2003**). Phase Distribution in a High Pressure Slurry Bubble Column via Computed Tomography, Oral Presentation, 4th Middle East Refining and Petrochemicals Conference and Exhibition, Manama, Bahrain, September 28- October 4.
153. Shaikh, A.; Al-Dahhan, M. H.; (**2003**). Flow Regime Delineation in Bubble Columns via Computed Tomography, Oral Presentation, AIChE Annual Meeting, San Francisco, USA, November 16-21.
152. S. Bhusarapu, Pascal Fongerland, M. H. Al-Dahhan and M. P. Duduković,(**2003**) Measurement and Modeling of Solids RTD in a Circulating Fluidized Bed (CFB) Riser, Oral Presentation, AIChE Annual Meeting, San Francisco, November 16-21.
151. S. Bhusarapu, M. H. Al-Dahhan and M. P. Duduković (**2003**) Solids Eulerian Flow Field from Lagrangian Information in a Gas-Solid Riser using Computer Automated Radioactive Particle Tracking, Oral Presentation, AIChE Annual Meeting, San Francisco.
150. Mehul S Vesvikar, Muthanna Al-Dahhan, (**2003**). Flow Pattern Visualization in a Mimic Anaerobic Digester using CFD. AIChE Annual meeting, San-Francisco, November 16-21.
149. Mehul S Vesvikar, Rajneesh Varma, Khursheed Karim, Muthanna Al-Dahhan, (**2003**) Flow Pattern Visualization in a Mimic Anaerobic Digester: Experimental and Computational Studies, AIChE Annual meeting, San-Francisco, November 16-21.
148. Hu-Ping Luo and Muthanna H. Al-Dahhan (**2003**). Analyzing and Modeling of Photo bioreactors by Combining First Principles of Physiology and Hydrodynamics, AIChE Annual meeting, San-Francisco, November 16-21
147. K. Karim, R. Hoffman, Thomas Klasson, M. H. Al-Dahhan, (**2003**). Anaerobic digestion of animal waste: effect of mode of mixing. AIChE Annual meeting, San-Francisco, November 16-21.

146. J. Xue, M. H. Al-Dahhan, M. P. Dudukovic', R. F. Mudde, (**2003**). Bubble dynamics measurements in bubble columns using four-point optical probe. AIChE Annual meeting, San-Francisco, November 16-21.
145. J. Guo and M. H. Al-Dahhan (**2003**). Modeling verification and application for catalytic wet oxidation in packed bed reactors. AIChE Annual meeting, San-Francisco, November 16-21.
144. Mehul S Vesvikar, Muthanna Al-Dahhan, (**2003**). Flow Pattern Visualization in a Mimic Anaerobic Digester using CFD, poster presentation, Computational Fluid Dynamics in Chemical Reaction Engineering III, Davos, Switzerland, May 25-30.
143. Karim, K., Klasson, K.T., Hoffmann, R., Dresher, S.R., DePaoli, D.W. and Al-Dahhan, M.H. (**2003**) "Anaerobic digestion of animal waste: Effect of mixing", International Conference on Energy and Environment, Halkidiki, Greece, 14-16 May.
142. J. Xue, M. H. Al-Dahhan, M. P. Dudukovic', R. F. Mudde, (**2003**). Bubble dynamics measurements using four-point optical probe. 6th Gas-liquid and Gas-liquid-solid Symposium (GLS6), Vancouver, British Columbia, Canada, August 17-20.
141. M. Vesvikar, R. Varma, S. Bhusarapu, S. Roy, A. Shaikh, H. Luo, M. Al-Dahhan, M. P. Dudukovic', (**2003**). Flow measurement techniques-CARPT and CT, Washington University, Sesquicentennial Week, November, 10-14.
140. H. Luo and M. H. Al-Dahhan (**2003**). Microalgae culturing in air-lift bioreactors, Washington University, Sesquicentennial Week, November, 10-14.
139. J. Xue, M. H. Al-Dahhan, M. P. Dudukovic', R. F. Mudde, (**2003**). Optical probe for bubble dynamics. Washington University, Sesquicentennial Week, November, 10-14.
138. K. Karim, R. Verma, M. Vesvikar, R. Hoffman (**2003**). Performance and hydrodynamic characterization of anaerobic digesters. Washington University, Sesquicentennial Week, November, 10-14.
137. Al-Dahhan M.H., Luo H.-P.**,** Kemoun A., Fernandez J.M., Grima E.M. (**2002**). Analysis of Photo bioreactor for Culturing High Value Products: Microalgae and Cyanobacteria via Advanced Diagnostic Techniques. 17th International Symposium on Chemical Reaction Engineering (ISCRE17), Hong Kong, Aug. 25-28.
136. J. M. Fernandez, J. L. Garcia, F. Garcia, E. Molina, M. H. Al-Dahhan, H. Luo, A. Kemoun, (**2002**). Integration of fluid dynamics light regime and photosynthetic response in photo bioreactors, 1st Congress on the International Society for Applied Phycology/ 9th International Conference on Applied Algology, Aquaduke, Almeria, Spain, May 26-30
135. H. Luo, A. Kemoun, M. H. Al-Dahhan, J. M. Fernandez, J. L. Garcia, E. Molina, (**2002**). Advanced measurement techniques for characterizing microalgae photo bioreactors, 1st Congress on the International Society for Applied Phycology/ 9th International Conference on Applied Algology, Aquaduke, Almeria, Spain, May 26-30
134. S. Bhusarapu, M. H. Al-Dahhan, M. P. Dudukovic' (**2002**). Flow visualization in gas-solid riser. MFDRC, Purdue University, West Lafayette, April, 22-24.
133. S. Bhusarapu, M. H. Al-Dahhan, M. P. Dudukovic' (**2002**). Residence time distribution of solids in gas-solid riser, MFDRC, Ohio, September 30- October 2.
132. Luo, H.-P. and Al-Dahhan, M.H. (**2002**). Photo bioreactors for Culturing High Value Microalgae and Cyanobacteria: Experimentation and Modeling. AIChE annual meeting, Indianapolis, Indiana, Nov. 3-8.
131. M. H. Al-Dahhan, B. Joseph, C. Carpenter, (**2002**). Prototype program for a joint academic/industry sponsored design course, International Conference on Engineering Education (ICEE 2002), Manchester, UK, August 18-21.
130. Shaikh, A. and Al-Dahhan, M. H.; (**2002**). Prediction of Overall Gas Holdup in Bubble Column via Neural Network Correlation, Oral Presentation, AIChE Spring Meeting, New Orleans, USA, March 10-14.
129. Rados, N.; Kemoun, A.; Shaikh, A.; Al-Dahhan, M. H.; Dudukovic, M. P.; (**2002**). Implementation of Radioactive Particle Tracking and Tomography in Flow Visualization of High Pressure Slurry Bubble

Column Reactors, Oral Presentation, 4th Symposium on High Pressure Technology and Chemical Engineering, Venice, Italy, September 22-25.
128. Shaikh, A.; Al-Dahhan, M. H.; (**2002**). Prediction of Overall Gas Holdup in Bubble Column via Artificial Neural Network Correlation, Oral Presentation, ISCRE 17, Hong Kong, China, August 25-28.
127. S. Bhusarapu, P. Fongarland, M. H. Al-Dahhan and M. P. Duduković (**2002**) A Non-Invasive Method for Overall Solids Flux Measurements in a Circulating Fluidized Bed (CFB), Poster Presentation, CFB7 Conference, Niagara Falls, Canada, May 5-8.
126. Karim, K., Vesvikar, M., Varma, R., and Al-Dahhan, M.H., (**2002**). Flow pattern imaging inside a simulated digester using computer automated particle tracking technique (CARPT)," AICHE annual meeting, Indianapolis, Indiana, Nov. 3-8.
125. N. Rados, M. H. Al-Dahhan, M. P. Dudukovic (**2002**). Modeling of Fisher-Tropsch Synthesis in Slurry Bubble Column Reactors, presented at International Symposium on Catalysis in Multiphase Reactor (CAMURE 4), Laussane, Switzerland, September 22-25.
124. Rammohan, A. R., Kemoun, A., Al-Dahhan, M. H., and Dudukovic M. P. (**2002**). Gas liquid flows in stirred tank reactors. AIChE Annual Meeting, Indianapolis, Indiana, November 3-8.
123. N. Rados, M. H. Al-Dahhan, M. P. Dudukovic (**2002**). Modeling of Fisher-Tropsch Synthesis in Slurry Bubble Column Reactors, Oral Presentation, ISCRE 17, Hong Kong, China, August 25-28
122. M. Al-Dahhan, (**2002**). Diagnostic techniques for slurry bubble column reactors. UCR-DOE Review Meeting, Pittsburgh, PA, June 1-5.
121. J. Xue, M. H. Al-Dahhan, M. P. Dudukovic', R. F. Mudde, (**2002**). Bubble dynamics measurements using four-point optical probe. AIChE Annual Meeting, Indianapolis, Indiana, November 3-8.
120. S. Bhusarapu, P. Fongerland, A. Vold, M. H. Al-Dahhan, M. P. Dudukovic, (**2002**). A non-invasive method for overall solids flux measurement in a circulating fluidized bed (CFB). AIChE Annual Meeting, Indianapolis, Indiana, November 3-8.
119. A. Rammohan, A. Kemoun, M. H. Al-Dahhan, M. P. Dudukovic' (**2002**), Gas holdup distribution in a stirred tank reactor, AIChE Annual Meeting, Indianapolis, Indiana, November 3-8.
118. J. Guo and M. H. Al-Dahhan (**2002**). Modeling of catalytic reaction in trickle bed and upflow packed bed reactor. AIChE Annual Meeting, Indianapolis, Indiana, November 3-8.
117. J. Guo and M. H. Al-Dahhan (**2002**). Catalytic wet oxidation of phenol by hydrogen peroxide over pillared clay catalyst. AIChE Annual Meeting, Indianapolis, Indiana, November 3-8.
116. P. Spicka, M. H. Al-Dahhan, M. P. Dudukovic, (**2002**). Effect of sparger nozzle orientation on gas-holdup and liquid recirculation in gas-liquid columns. AIChE Annual Meeting, Indianapolis, Indiana, November 3-8.
115. M. H. Al-Dahhan, (**2002**). Flow visualization of multiphase flow systems, the 6th Saudi Engineering Conference, Thermal Systems, Dhahran, Saudi Arabia, December 14-17.
114. M. H. Al-Dahhan, (**2002**). Integrated approach of computing and computer applications at an early stage of undergraduate engineering program, the 6th Saudi Engineering Conference, Thermal Systems, Dhahran, Saudi Arabia, December 14-17
113. Shaikh, A., Al-Dahhan, M. H. (**2001**). Development of Neural Network based Correlation for Overall Gas Holdup in Bubble Column, AIChE Annual Meeting, Reno, NV, USA, November 4-9.
112. Wu, Y., Shaikh, A., Al-Dahhan, M. H. (**2001**). Prediction of Mass Transfer Coefficient in Bubble Columns at High Pressure Operation, Poster Presentation, AIChE Annual Meeting, Reno, NV, USA, November 4-9.
111. A. Dambal and M. H. Al-Dahhan (**2001**). Effect of high pressure operation on relative permeability in trickle bed reactors, AIChE Annual Meeting, Reno, NV, USA, November 4-9
110. M. Rafique, M. H. Al-Dahhan, M. P. Dudukovic' (**2001**). The merits/demerits of different closures on the dynamics of bubble columns. AIChE Annual Meeting, Reno, NV, USA, November 4-9.
109. M. P. Dudukovic, Shantanu Roy and M. H. Al-Dahhan, (**2001**). 'Flow Mapping and Modeling of Liquid-Solid Risers', Presented at XV International Conference of Chemical Reactors CHEMREACTOR XV, Helsinki, Finland, June 5-8.

108. S. Roy, F. Larachi, M. H. Al-Dahhan and M. P. Dudukovic, (**2001**). "Resolution and Sensitivity in Computer Automated Radioactive Particle Tracking (CARPT)", Advances in Signal Processing for Non-Destructive Evaluation of Materials, IVth International Workshop, Quebec City, Canada, August 7-10.
107. Alvaré, J., Al-Dahhan, M.H., (**2001**). "Overall Liquid Phase Mixing in Trayed Bubble Columns", AIChE Annual Meeting, Reno, NV, USA, November 4-9.
106. Rammohan, A. R., Kemoun, A., Al-Dahhan, M. H., and Dudukovic M. P. (**2001**). Characterization of single-phase flow in a stirred tank using Computer Automated Radioactive Particle Tracking (CARPT), Fourth International Symposium on Mixing in Industrial Processes, Toulouse, France
105. Y. Jiang, M.R. Khadilkar, M.H. Al-Dahhan, M.P. Dudukovic, (**2001**), Macroscale multiphase flow modeling using k-fluid model, 4th International conference on multiphase flow, New Orleans, LA, May 27-June 1.
104. Fernandez, J.M., E. Molina Grima, F. Garcia, A. Kemoun, M.H. Al-Dahhan, (**2001**), Irradiance frequency and cell movement in microalgal photo bioreactors, 4th International Asia-Pacific Marine Biotechnology Conference, Hawaii, October 21-24.
103. A. Kemoun, N. Rados, F. Li, M. H. Al-Dahhan, M. P. Dudukovic, P. L. Mills, T. M. Leib and J. J. Lerou,(**2000**). Gas Holdup in a Trayed Cold-Flow Bubble Column", ISCRE Meeting, Krakow, Poland.
102. J.M. Fernandez, Muthanna H. Al-Dahhan, A. Kemoun, E. Molina Grima, F. Garcia, (**2000**) "Cells movement and irradiance frequencies in the microalgal photo bioreactors", 4th European Workshop – Biotechnology of Microalgae, European Society of Microalgal Biotechnology, Potsdan, Germany, May 29-30.
101. Amy, Christina Wiegand, Steve Picker, Muthanna Al-Dahhan, (**2000**) Production of clean fuel: A biochemical experiment for unit operation lab developed through undergraduate research project, AIChE Regional Conference, Washington University, St. Louis, MO, March 24-26.
100. S. Roy, F. Larachi, Muthanna H. Al-Dahhan, M.P. Dudukovic, (**2000**) "Resolution and sensitivity in computer automated radioactive particle tracking (CARPT)", Photonics East Conference, SPIE, Process Imaging for Automatic Control, Session 2, Modeling and Control, Boston, MA, November 5-8.
99. D. Tasamatsoulis, Muthanna H. Al-Dahhan, F. Larachi, N. Papayannakos, (**2000**) "The particle dilution effect on catalyst wetting efficiency and liquid film thickness in laboratory trickle-bed reactors", 3rd Int. Symp. on Catalysis in Multiphase Reactors, Naples, Italy, May 29-31.
98. Y. Jiang, M.R. Khadilkar, Muthanna H. Al-Dahhan, M.P. Dudukovic, (**2000**) "CFD modeling of multiphase flow distribution in catalytic packed-bed reactors: scale down issues", 3rd Int. Symp. on Catalysis in Multiphase Reactors, Naples, Italy, May 29-21.
97. Y. Jiang, Muthanna H. Al-Dahhan, M.P. Dudukovic, (**2000**) "A parallel approach to catalyst and reactor selection for a fine chemical process", 3rd Int. Symp. on Catalysis in Multiphase Reactors, Naples, Italy, May 29-31.
96. P. Gupta, B.C. Ong, Muthanna H. Al-Dahhan, M.P. Dudukovic, B.A. Toseland, (**2000**) "Hydrodynamics of Churn-turbulent bubble columns: gas-liquid recirculation and mechanistic modeling", 16th Canadian Symposium on Catalysis, Banff, Canada, May 23-26.
95. Y. Jiang, M.R. Khadilkar, Muthanna H. Al-Dahhan, M.P. Dudukovic, (**2000**) "CFD modeling of fluid flow packed beds", Engineering Foundation – Chemical Reaction Engineering VII: Computational Fluid Dynamics in Chemical Reaction Engineering, Quebec, Canada, August 6-11.
94. Muthanna H. Al-Dahhan, (**2000**) "Advanced Diagnostics technique for three-phase slurry bubble column reactors (SBCR)", DOE Review Meeting, Pittsburgh, PA, June 6-7.
93. Y. Wu, B.C. Ong, Muthanna H. Al-Dahhan, (**2000**)Prediction of radial gas holdup profiles in bubble columns reactors", 16th International Symposium on Chemical Reaction Engineering (ISCRE 16), Krakow, Poland, September 10-13.
92. Y. Wu, Muthanna H. Al-Dahhan, (**2000**) "Prediction of axial liquid velocity profile in bubble columns", ISCRE 16, Krakow, Poland, September 10-13
91. Y. Jiang, Muthanna H. Al-Dahhan, M.P. Dudukovic, (**2000**) "Statistical characterization of macroscale multiphase flow textures in trickle beds", 16th International Symposium on Chemical Reaction Engineering (ISCRE 16), Krakow, Poland, September 10-13.

90. P. Gupta, Muthanna H. Al-Dahhan, M.P. Dudukovic, B.A. Toseland, (**2000**) "Comparison of single and two-bubble class gas-liquid recirculation models – application to pilot plant radioactive tracer studies during methanol synthesis", ISCRE 16, Krakow, Poland, September 10-13.
89. A. Kemoun, N. Rados, Muthanna H. Al-Dahhan, M.P. Dudukovic, P.L. Mills, T.M. Leib, J.J. Lerou, (**2000**) "Gas holdup in a trayed cold-flow bubble column", ISCRE 16, Krakow, Poland, September 10-13.
88. S. Roy, A. Kemoun, Muthanna H. Al-Dahhan, M.P. Dudukovic, (**2000**) "Interpretation of solids mixing in liquid-solid risers via CARPT", AIChE Annual Meeting, Industrial Applications of Multiphase Reactors, Los Angeles, CA, November 12-17.
87. W. Highfill, B.T. Ong, Muthanna H. Al-Dahhan, (**2000**) "Drawbacks in the measurement of liquid-solid mass transfer coefficient in two-phase flow packed bed reactors operated at low and high pressure", AIChE Annual Meeting, Kinetics, Catalysis and Reaction Engineering, Los Angeles, CA, November 12-17.
86. Muthanna H. Al-Dahhan, (**2000**) "Gas-solid riser", MFDRC Review Meeting, Midland, MI, September 16-17.
85. M.P. Dudukovic, Muthanna H. Al-Dahhan, (**2000**) "CARPT studies of gas-solid risers", MFRDC Meeting, Sandia, Albuquerque, NM, April 12-14.
84. M.P. Dudukovic, Muthanna H. Al-Dahhan, B.C. Ong, A. Kemoun, N. Rados, (**2000**) "Distributor effects on gas holdup profiles in bubble columns", DOE Review Meeting, Sandia National Laboratory, Albuquerque, NM, May 9.
83. M.P. Dudukovic, Muthanna H. Al-Dahhan, B.C. Ong, A. Kemoun, N. Rados, (**2000**) "Bubble column hydrodynamics", Air Products Review Meeting, Allentown, PA, May 24.
82. Muthanna H. Al-Dahhan, Steve Picker, Cristina Weigand, Amy Chen, (**2000**) "Production of clean fuel: a biochemical experiment for unit operations laboratory", ASEE Annual Conference, Session 2513 (The greening of the ChE Curriculum), St. Louis, MO, June 18-21.
81. Muthanna H. Al-Dahhan, (**2000**) "Integration of design and selection of process engineering components into unit operation laboratory", ASEE Annual Conference, Session 2559 (Instrumentation), St. Louis, MO, June 18-21.
80. Muthanna H. Al-Dahhan, (**2000**) "Incorporation of graduate facilities into undergraduate unit operations laboratory", ASEE Annual Conference, Session 3413 (ChE Laboratories in the Next Millennium), St. Louis, MO, June 18-21.
79. Muthanna H. Al-Dahhan, A. Kemoun, J.M. Fernandez, E. Molina Grima, F. Garcia, (**2000**) "Computer automated radioactive particle tracking (CARPT) Applied to microalgal photo bioreactors", 219th American Chemical Society (ACS) National Meeting – Biochemical Technology division, San Francisco, CA, March 26-30.
78. Muthanna H. Al-Dahhan, A. Kemoun, J.M. Fernandez, J.L. Garcia, F.G. Gamacho, E.G. Molina, (**2000**) "Characterization of irradiance frequencies in the microalgal photo bioreactors via radioactive particle tracking", AIChE Annual Meeting, Session 358 – Multiphase Reactors in Biochemical Technology, Modeling Experimentation and Applications, Los Angeles, CA, November 12-17.
77. S. Roy, M. P. Dudukovic, M. H. Al-Dahhan and F. Larachi, (**1999**) "Flow Mapping In a Gas-Solids Riser using Computer Automated Radioactive Particle Tracking (CARPT): A Proposed Study", DOE/OIT-MFDRC Review Meeting, Washington DC, USA, February 10.
76. S. Roy, A. Kemoun, M. H. Al-Dahhan and M. P. Dudukovic, (**1999**) "Dense, Vertical Liquid-Solid Flow in a Riser: Experimental Analysis", Presented at NHTC '99: The 33rd National Heat Transfer Conference, Albuquerque, NM, USA, August 15-17.
75. S. Roy, A. Kemoun, M. H. Al-Dahhan and M. P. Dudukovic, (**1999**) "Non-Intrusive Measurement of Solids Dispersion in a Liquid-Solid Riser", AIChE Annual Meeting, Dallas, TX, USA, November.
74. A. Kemoun, N. Rados, B. C. Ong, M. H. Al-Dahhan, and M. P. Dudukovic (**1999**). Implementation of CARPT in High Pressure Bubble/Slurry Bubble Column", AIChE Annual Meeting, Dallas, TX, USA.
73. J. Chen., N. Rados, M. H. Al-Dahhan, M. P. Dudukovic, (**1999**) Particle Motion in Packed/ Ebullated Beds by CT and CARPT, AIChE Annual Meeting, Dallas, TX, USA
72. Alvaré, J., Al-Dahhan, M.H., (**1999**). "Gas Holdup in Trayed Bubble Columns", AIChE Annual Meeting, Dallas, TX.

71. Rammohan, A. R., Kemoun, A., Al-Dahhan, M. H., and Dudukovic M. P. (**1999**). Characterization of single-phase flow in a stirred tank using Computer Automated Radioactive Particle Tracking (CARPT) MIXING XVII, 17th North American Mixing Conference, Alberta, Canada

70. Rammohan, A. R., Ranade, V. V., Kemoun, A., Al-Dahhan, M. H., and Dudukovic M. P. (**1999**). Motion of neutrally buoyant particles in stirred vessels: Computer Automated Radioactive Particle Tracking (CARPT) and CFD simulations.. MIXING XVII, 17th North American Mixing Conference, Alberta, Canada.

69. Rammohan, A. R., Kemoun, A., Al-Dahhan, M. H., and Dudukovic M. P. (**1999**). Characterization of single-phase flow in a stirred tank using Computer Automated Radioactive Particle Tracking (CARPT) AIChE Annual Meeting, Dallas, TX

68. S. Roy, M.P. Dudukovic, M.H. Al-Dahhan, F. Larachi, (**1999**) "Flow mapping in a gas-solid riser using computer automated radioactive particle tracking (CARPT)", DOE/OIT-MFDRC Review Meeting, Washington DC, February 10.

67. Y. Jiang, M. Al-Dahhan, M.P. Dudukovic, (**1999**) "Advanced multiphase flow modeling in packed-bed reactor", Engineering Center, DuPont Engineering Center, Wilmington, DE, July.

66. S. Roy, A. Kemoun, M.H. Al-Dahhan, M.P. Dudukovic, (**1999**) "Dense, vertical liquid-solid flow in a riser: experimental analysis", The 33rd National Heat Transfer Conference, Albuquerque, NM, August 15-17.

65. A. Kemoun, A. Rammohan, M.H. Al-Dahhan, M.P. Dudukovic, (**1999**) "Characterization of single phase flow in a stirred tank using computer automated radioactive particle tracking (CARPT)", Mixing XVII, 17th Biennial North America Mixing Conference, Banff, Alberta, Canada, August 15-20.

64. V.V. Ranada, A. Rammohan, A. Kemoun, M.H. Al-Dahhan, M.P. Dudukovic, (**1999**) "Motion of neutrally buoyant particles in stirred vessels: CARPT experiments and CFD simulations, Mixing XVII, 17th Biennial North America Mixing Conference, Banff, Alberta, Canada, August 15-20.

63. P. Gupta, B.C. Ong, M.H. Al-Dahhan, M.P. Dudukovic, (**1999**) "Investigation of liquid mixing in churn-turbulent bubble column using conductivity probes", Mixing XVII, 17th Biennial North America Mixing Conference, Banff, Alberta, Canada, August 15-20.

62. S. Roy, R. Dodson, F. Larachi, M.H. Al-Dahhan, M.P. Dudukovic, (**1999**) "Flow mapping in a gas-solid riser via computer automated radioactive particle tracking", Annual Meeting of the Multiphase Fluid Dynamics Research Consortium (MFDRC), Mendenhall, Pennsylvania, September 26-28.

61. J. Chen, N. Rados, M.H. Al-Dahhan, M.P. Dudukovic, D. Nguyen, K. Parimi, (**1999**) "Study of particle motion in packed/ebullated beds with computed tomography (CT) and computer automated radioactive particle tracking (CARPT)", 49th Canadian Chemical Engineering Conference (CCEC), Saskatoon, Saskatchewan, October 3-6.

60. S. Roy, A. Kemoun, M.H. Al-Dahhan, M.P. Dudukovic, (**1999**) "Non-intrusive measurement of solids dispersion in a liquid-solid riser", Paper 139f, AIChE Annual Meeting, Dallas, Texas, October 31-November 5.

59. J. Chen, N. Rados, M.H. Al-Dahhan, M.P. Dudukovic, D. Nguyen, K. Parimi, (**1999**) "Measuring incipient particle motion in three phase packed/ebbullated beds with computed tomography (CT) and computer automated radioactive particle tracking (CARPT)", Paper 140e, AIChE Annual Meeting, Dallas, Texas, October 31- November 5.

58. A. Kemoun, R. Rammohan, M.H. Al-Dahhan, M.P. Dudukovic, (**1999**) "Characterization of single phase flow in a stirred tank reactor using computer automated radioactive particle tracking (CARPT)", Paper 166e, AIChE Annual Meeting, Dallas, Texas, October 31- November 5.

57. A Kemoun, B.C. Ong, P. Gupta, M.H. Al-Dahhan, M.P. Dudukovic, (**1999**) "Gas-holdup in a high pressure bubble column by computed tomography", Paper 304c, AIChE Annual Meeting, Dallas, Texas, October 31- November 5.

56. J. Alvare, M.H. Al-Dahhan, C. Dassori, (**1999**) "Gas holdup in trayed bubble columns", Paper 306e, AIChE Annual Meeting, Dallas, Texas, October 31- November 5.

55. Y. Jiang, M.H. Al-Dahhan, M.P. Dudukovic, (**1999**) "Mixing-cell network model for design of trickle-bed reactors", Paper 306f, AIChE Annual Meeting, Dallas, Texas, October 31- November 5.

54. Y. Jiang, M.H. Al-Dahhan, M.P. Dudukovic, (**1999**) "Statistical characterization of two phase flow in bubble column", Paper 309f, AIChE Annual Meeting, Dallas, Texas, October 31- November 5.
53. P. Gupta, M.H. Al-Dahhan, M.P. Dudukovic, P.L. Mills, (**1999**) "A novel filtering method for determination of liquid-phase tracer responses in bubble columns from conductivity probe measurements", Paper 314j, AIChE Annual Meeting, Dallas, Texas, October 31- November 5.
52. M. R. Khadilkar, M. H. Al-Dahhan, M. P. Dudukovic, (**1998**) "Parametric study of unsteady state flow modulation in trickle bed reactors", ISCRE15, Newport Beach, California, September 13-16.
51. Y. Jiang, M. R. Khadilkar, M. H. Al-Dahhan, M. P. Dudukovic, (**1998**) "Two phase flow distribution in 2d trickle-bed reactors", ISCRE15, Newport Beach, California, September 13-16.
50. J. Chen, F. Li, S. Degaleesan, P. Gupta, M. H. Al-Dahhan, M. P. Dudukovic, B. Toseland, (**1998**) "Fluid dynamic parameters in bubble columns with internals", ISCRE15, Newport Beach, California, September 13-16.
49. J. Chen, A. Kemoun, M. H. Al-Dahhan, M. P. Dudukovic, D. J. lee, L.-S. Fan, (**1998**) "Comparative hydrodynamics study in a bubble column using computer automated radioactive particle tracking (CARPT) / computed tomography (CT) and particle image velocimetry (PIV)", ISCRE15, Newport Beach, California, September 13-16.
48. S. Saberi, M.H. Al-Dahhan, M.P. Duducovic, B. Toseland, (**1998**) "Parametric analysis of one dimensional modeling of gas-liquid flow in bubble column", Paper 242k, AIChE Annual Meeting, Miami Beach, Florida, November 15-20.
47. M. R. Khadilkar, M.H. Al-Dahhan, M.P. Dudukovic, (**1998**) "Unsteady state flow modulation in trickle bed reactors: experiments and model predictions", Paper 318bh, AIChE Annual Meeting, Miami Beach, Florida, November 15-20.
46. Y. Jiang, M.H. Al-Dahhan, M.P. Dudukovic, (**1998**) "Gas flow modeling in packed beds", Paper 318bi, AIChE Annual Meeting, Miami Beach, Florida, November 15-20.
45. W. Highfill, M.H. Al-Dahhan, (**1998**) "Liquid-solid mass transfer coefficient in high pressure trickle bed reactors", Paper 318bj, AIChE Annual Meeting, Miami Beach, Florida, November 15-20.
44. W. Highfill, M.H. Al-Dahhan, (**1998**) "Liquid holdup measurement techniques in high pressure laboratory trickle-bed reactors", Paper 318bk, AIChE Annual Meeting, Miami Beach, Florida, November 15-20.
43. J. Chen, F. Li, M.H. Al-Dahhan, M.P. Dudukovic, B. Toseland, (**1998**) "liquid turbulence and backmixing in large diameter bubble columns with internals", Paper 242i, AIChE Annual Meeting, Miami Beach, Florida, November 15-20.
42. Y. Jiang, M.H. Al-Dahhan, M.P. Dudukovic, (**1998**) "Liquid flow maldistribution and reaction performance in trickle-bed reactors", Paper 304e, AIChE Annual Meeting, Miami Beach, Florida, November 15-20.
41. M.H. Al-Dahhan, M.P. Dudukovic, (**1998**) "Scale-up in reaction engineering"– invited lecture - Paper 307a, AIChE Annual Meeting, Miami Beach, Florida, November 15-20.
40. S. Roy, A. Kemoun, M.H. Al-Dahhan, M.P. Dudukovic, (**1998**) "Experimental investigation of flow in a liquid-solid riser", Paper 165g, AIChE Annual Meeting, Miami Beach, Florida, November 15-20.
39. Y. Jiang, J. Mettes, M. Khadilkar, M.H. Al-Dahhan, (**1998**) "Experimental investigation of liquid flow distribution in trickle-bed reactors under steady state and periodic operation", paper 181-1b; won the 2nd place in National Student paper competition – section of Engineering Sciences and Fundamental, AIChE Annual Meeting, Miami Beach, Florida, November 15-20.
38. S. Roy, J. Chen, S. Degaleesan, P. Gupta, M.H. Al-Dahhan, M.P. Dudukovic, (**1998**) "Non-invasive flow monitoring in opaque multiphase reactors via CARPT and CAT", paper FEDSM98-5077 ASME Fluids Engineering Division Summer Meeting, Washington, DC, USA, June 21-25.
37. Y. Wu, M. Khadilkar, M. H. Al-Dahhan, M. P. Dudukovic, (**1997**) "Effect of catalyst wetting on the performance of trickle-bed reactors", Second Joint U.S./China Chemical Engineering Conference, Beijing, China, May 19-22.
36. M. P. Dudukovic, M. H. Al-Dahhan, M. Khadilkar, Y. Wu, (**1997**) "Study of trickle-bed reactor performance under periodic operation", Second Joint U.S./China Chemical Engineering Conference, Beijing, China, May 19-22.

35. J. Chen, P. Gupta, M. H. Al-Dahhan, S. B. Kumar, M. P. Dudukovic, (**1997**) "Gas holdup in bubble columns measured by computer tomography", Frontiers in Industrial Process Tomography - II, Delft, The Netherlands, April.
34. M. P. Dudukovic, M. H. Al-Dahhan, P. Gupta, Y. Yang, S. Degaleesan, L. S. Fan, P. Jiang, J. Reese, D. L. Lee, R. F. Mudde, M. Chang, (**1997**) "Novel techniques for slurry bubble column hydrodynamics", The Annual Review Meeting, University Coal Research Program, Department of Energy, Pittsburgh, Pennsylvania, June 3-4.
33. S. Roy, J. Chen, S. Kumar, M. H. Al-Dahhan, M. P. Dudukovic, (**1997**) "Flow pattern studies in liquid-solid riser reactor", Chemical Reactor Engineering for Sustainable Processes and Products, Chemical Reaction Engineering VI, Engineering Foundation Conference, Banff, Canada, June 8-13.
32. M. H. Al-Dahhan, F. Larachi (Laval University), M. P. Dudukovic, (**1997**) "Recent advances in high pressure trickle-bed reactors", Chemical Reactor Engineering for Sustainable Processes and Products, Chemical Reaction Engineering VI, Engineering Foundation Conference, Banff, Canada, June 8-13.
31. M. R. Khadilkar, M. H. Al-Dahhan, M. P. Dudukovic' (**1997**) Simulation of unsteady state operation in trickle-bed reactors, Chemical Reactor Engineering for Sustainable Processes and Products, Chemical Reaction Engineering VI, Engineering Foundation Conference, Banff, Canada, June 8-13.
30. F. Larachi, M. H. Al-Dahhan, M. P. Dudukovic, (**1997**) "Trickle-Bed reactors at high pressure: a state-of-the-art review", Paper, 484, Session 48, 47th Canadian Chemical Engineering Conference, October 5-8, Edmonton, Alberta, Canada.
29. M. Khadilkar, M. H. Al-Dahhan, M. P. Dudukovic, (**1997**) "Simulation of unsteady state operation in trickle bed reactors", Paper 254e, AIChE Annual Meeting, Los Angeles, California, November 16-21.
28. M. Khadilkar, Y. Jiang, M. H. Al-Dahhan, M. P. Dudukovic, (**1997**) "Investigation of a complex reaction network in a high pressure trickle bed reactor", Paper 252a, AIChE Annual Meeting, Los Angeles, California, November 16-21.
27. Y. Jiang, M. Khadilkar, M. H. Al-Dahhan, M. P. Dudukovic, (**1997**) "Prediction of two phase flow distribution in 2D trickle bed reactors", Paper 276a, AIChE Annual Meeting, Los Angeles, California, November 16-21.
26. J. Chen, S. Degaleesan, M. H. Al-Dahhan, M. P. Dudukovic, B. Toseland, (**1997**) "Tracer data analysis with axial dispersion model for two pilot plant slurry reactors", Paper 150d, AIChE Annual Meeting, Los Angeles, California, November 16-21.
25. J. Chen, P. Gupta, F. Li, S. Degaleesan, S. Roy, M. H. Al-Dahhan, M. P. Dudukovic, B. Toseland, (**1997**) "Column scale effects on gas holdup and flow pattern in bubble columns", Paper 217d, AIChE Annual Meeting, Los Angeles, California, November 16-21.
24. M. Khadilkar, Y. Wu, M. Al-Dahhan, M.P. Dudukovic, (**1996**) "Comparison of trickle-bed and upflow reactor performance at high pressure: model predictions and experimental observations", ISCRE 14, Belgium, 5-8 May.
23. Y. Wu, M. Khadilkar, M. Al-Dahhan, M.P. Dudukovic, (**1996**) "Evaluation of a trickle bed reactor model using liquid limited chemical reaction", ISCRE 14, Belgium, 5-8 May.
22. M. H. Al-Dahhan, Y. Wu, M. Khadilkar, M. P. Dudukovic, (**1996**) "Improved prediction of pressure drop and liquid holdup in high pressure trickle-bed reactors", Paper 3L, 5th World Congress of Chemical Engineering, San Diego, July 14-18.
21. F. Larachi, M. H. Al-Dahhan, M. P. Dudukovic, A. Laurent, (**1996**) "High pressure trickle-bed reactors: a state-of-the-art review", 12th International Congress of Chemical & Process Engineering, CHISA'96, August.
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