CONTENTS

Index
Preface

FUNDAMENTALS OF SINGLE-PHASE MIXING

VOXER TRACKING IN STIRRED PROCESSES AND IMPLICATIONS FOR MIXING PRACTICE
A. Ducci and M. Yianneskis

A FEED STRATEGY TO EXTEND THE OPERATING CONDITIONS OF A CONTINUOUS STIRRED TANK REACTOR
J. Aubin, S. Kresta, C. Xuereb and D.F. Fletcher

OPERABILITY LIMITS OF CONTINUOUS-FLOW STIRRED TANKS
K. Samaras, P. Mavros and D. Zamboulis

PERIODIC LOW FREQUENCY INSTABILITIES AND FLOW STRUCTURES IN STIRRED TANKS
J. Kilander, F. Svensson and A. Rasmuson

DYNAMICS OF FREE LIQUID SURFACE MOTIONS IN A STIRRED TANK
P. Hasal, M. Jahoda and I. Fort

FLOW FIELD VARIATION BY MINOR MODIFICATIONS OF IMPELLER BLADES
D. Georgiev and S. Vlaev

AUTOCORRELATION FUNCTION AND INTEGRAL SCALE IN THE TANK WITH A SELF-ASPIRATING DISK IMPELLER
J. Stelmach

NUMERICAL SIMULATION OF LOW-REYNOLDS FLOW FIELDS IN UNBAFFLED STIRRED VESSELS
B. Gibbardo, G. Micale, F. Grisafi, A. Brucato and M. Ciofalo

MIXING OF VISCOUS AND NON-NEWTONIAN LIQUIDS

CFD ANALYSIS OF CAVERNS AND PSEUDO-CAVERNS DEVELOPED DURING MIXING OF NON-NEWTONIAN FLUIDS
L. Adams and M. Barigou

MIXING OF HIGH VISCOSITY FLUIDS: EXPERIMENTAL AND NUMERICAL EXPLORATIONS OF CO-AXIAL MIXERS
L. Rudolph, M. Schaefer, V. Atiemo-Obeng and M. Kraume

AN LDA STUDY OF THE FLOW INSIDE CAVERNS CREATED BY A HYDROFOIL IMPELLER
Z. Jaworski

NUMERICAL AND EXPERIMENTAL STUDY OF COAXIAL MIXERS FOR VISCOS NEWTONIAN AND NON-NEWTONIAN FLUIDS
M. Farhat, C. Rivera, L. Fradette, M. Heniche and P. Tanguy

PERFORMANCE OF A DUAL SHAFT MIXING SYSTEM IN VISCOUS NEWTONIAN LIQUIDS MIXING
F. Cabaret, C. Rivera, L. Fradette, M. Heniche and P. Tanguy

A 3D/2D HYBRID MODEL FOR RIBBON IMPELLERS OPERATING IN LAMINAR MOTION
C. Kunczewicz and M. Pietrzykowski

STIRRING OF VISCOELASTIC FLUIDS: POWER AND CIRCULATION
G.K. Patterson
3-D IMAGING OF FLOW STRUCTURES IN STIRRED VESSELS

GAS-LIQUID SYSTEMS

AIR ENTRAINMENT IN BAFFLED STIRRED TANKS
S. Bhattacharya, D. Hebert and S. Kresta

EXPERIMENTS AND SIMULATIONS OF GAS-LIQUID STIRRED VESSELS
G. Montante, A. Paglianti and F. Magelli

EXPERIMENTAL STUDY AND A MECHANISTIC MODEL ON THE EFFECT OF VENTILATED CAVITIES IN GASSED STIRRED VESSELS
A. Paglianti, M. Fujasova and G. Montante

POWER CONSUMPTION AND MIXING TIME IN STIRRING WITH MODIFIED IMPELLERS
A. Bombac and I. Zun

THE CHOICE OF PUMPING DIRECTION FOR GAS-LIQUID MIXING AND MASS TRANSFER IN A VESSEL MECHANICALLY AGITATED BY A RADIAL AGITATOR BELOW A PITCHED BLADE TURBINE
M. Cooke, P. Heggs and A. Perdriau

GAS DISPERSION CAPABILITIES OF THE CD-6 IMPELLER
K.J. Myers, E.E. Janz and J.B. Fasano

GAS MALDISTRIBUTION IN A FERMENTER STIRRED WITH MULTIPLE TURBINES
L. Montastruc, J.P. Brienne, M. Martinov and I. Nikov

GAS-LIQUID MASS TRANSFER IN STIRRED VESSELS: ROLE OF SMALL BUBBLES AND ASSESSMENT OF A TWO-FRACTION MODEL FOR NON COALESCENT OR MODERATELY VISCOUS LIQUIDS
D. Pinelli

MODELLING LOCAL GAS-LIQUID MASS TRANSFER IN AGITATED VESSELS
M. Laakkonen, P. Moilanen, V. Alopaeus and J. Aittamaa

SOLID-LIQUID AND THREE-PHASE SYSTEMS

THE EFFECT OF BOTTOM ROUGHNESS ON THE SUSPENSION OF PARTICLES IN STIRRED VESSELS
A. Ghionzoli, W. Bujalski, A. Nienow, R. Grenville and A. Paglianti

DE-AGGLOMERATION OF PRE-WETTED NANO-PARTICLES USING MIXED FLOW AND HIGH SHEAR IMPELLERS
L. Xie, C. Rielly, W. Eagles and G. Ozcan-Taskin

RHEOLOGICAL EFFECTS IN CONCENTRATED AGGREGATED SUSPENSIONS – APPLICATION OF POPULATION BALANCE MODELING
J. Baldyga, A. Krasinski and W. Orciuich

THE EFFECT OF SOLIDS ON THE DENSE PHASE GAS FRACTION AND GAS-LIQUID MASS TRANSFER AT CONDITIONS CLOSE TO THE HETROGENEOUS REGIME IN A MECHANICALLY AGITATED VESSEL
M. Cooke, P. Heggs and T. Rodgers

 DISTRIBUTION OF MIXED SOLIDS IN AGITATED SUSPENSIONS
G. Montante and F. Magelli

PARTICLE DISTRIBUTION IN STIRRED TANKS: EXPERIMENTAL AND NUMERICAL INVESTIGATIONS IN DIFFERENT SCALES
R. Angst and M. Kraume
NEW REGIMES AND CORRELATIONS FOR JUST SUSPENDED SPEED
L. Uby

OFF-BOTTOM SOLIDS SUSPENSION AND DRAWDOWN BY MEANS OF STANDARD AND DUAL AGITATORS WITH FLAT- AND HOLLOW-BLADE TURBINES
L. Broniarz-Press, J. Borowski and K. Okrajek

EFFECT OF VESSEL BOTTOM SHAPE ON PARTICLE SUSPENSION WITH HIGH CONCENTRATED SUSPENSIONS
J. Moravec, T. Jirout and F. Rieger

COMPARISON OF SOLID-LIQUID MIXING PERFORMANCE BETWEEN A PITCHED BLADE TURBINE AND THE MAXBLEND IMPELLER

POWER DRAW, SOLIDS SUSPENSION AND LIQUID MIXING WITH A RETREAT CURVE IMPELLER IN A CONICAL-BASED VESSEL
M. Habib, C. Rielly and J.P. Sherlock

SUSPENSION OF NANOPARTICLE AGGLOMERATES IN A LIQUID
G. Ozcan-Taskin, W. Eagles, P. Clements, L. Xie and C. Rielly

IMPACT OF IMPELLER POSITION ON THE COMPLETE DRAWDOWN OF FLOATING SOLIDS IN AGITATED VESSEL PROVIDED WITH MULTIPLE IMPELLERS
N. Kuzmanic, M. Akrap, E. Mitrovic Kessler and V. Jakus

LIQUID-LIQUID SYSTEMS

THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF DISPERSED PHASE VISCOSITY ON DROP COALESCENCE
W. Podgorska

MODELING THE MIXING AND DISSOLUTION KINETICS OF PARTIALLY MISCELLNEOUS LIQUIDS
S. Ibemere and S. Kresta

THE ROLE OF THE EMULMULSIFIERS AND MIXING ENERGY ON THE CHARACTER AND STABILITY OF COSMETIC EMULSIONS
B. Tal-Figiel

EMULSION SYSTEMS WITH TAILORED DROP SIZE AND MORPHOLOGY BY DISPERSIVE AND DISTRIBUTIVE MIXING WITH ROTATING MEMBRANES (ROME PROCESS)
E.J. Windhab, V. Schadler and N. Mueller-Fischer

DROP BREAKAGE AND DAUGHTER DROP DISTRIBUTIONS IN STIRRED LIQUID/LIQUID SYSTEMS AND THEIR MODELLING WITHIN THE POPULATION BALANCE EQUATION
S. Maass, A. Gaebler, M. Wegener, A. Zaccoone, A.R. Paschedag and M. Kraume

PRODUCTION OF FINE DROPLET EMULSIONS IN THE AGITATED DRAFT-TUBE COLUMN REACTOR
B. Kawalec-Pietrenko and J. Grysiko

MIXING AND MICROMIXING IN REACTORS AND BIOREACTORS

MIXING IN BIOREACTORS USING AGITATORS WITH A LARGE SWEPT VOLUME
H. Zhu, W. Bujalski, C. Hewitt, A. Nienow and M. Simmons

DETERMINATION OF THE SEGREGATION INDEX TO SENSE THE MIXING QUALITY OF SCALE-UP CONCEPTS FOR PILOT- AND PRODUCTION-SCALE MICROSTRUCTURED MIXERS
V. Hessel, T. Baier, H. Loewe, P. Loeb, Y. Men and B. Werner
SELECTIVITY DETERMINATION OF IODIDE–IODATE MICROMIXING REACTION SYSTEM
BY EXPERIMENTAL METHOD
A. Dekajlo, Z. Jaworski, A. Hall and F. Muller

MODELING OF REACTIVE MICROMIXING OF LIQUIDS DIFFERING IN VISCOSITY IN
LAMINAR FLOWS
A. Rozen

EFFECT OF MIXING ON AGGREGATION OF NANOPARTICLE DISPERSIONS UNDER
TURBULENT CONDITIONS
M. Soos, D. Marchisio, J. Sefcik, R.O. Fox and M. Morbidelli

MEASURING TECHNIQUES FOR MIXING
CHARACTERIZATION OF MACRO-MIXING KINETICS USING ADVANCED IMAGE
ANALYSIS
F. Cabaret, L. Fradette and P. Tanguy

USING ULTRASONIC DOPPLER VELOCIMETRY TO MEASURE FLOW VELOCITY IN PULP
SUSPENSION MIXING
F. Ein-Mozaffari, D. Buckingham, C. Bennington and G. Dumont

RECONSTRUCTION OF 3-D FLOW FIELD INSIDE MINIATURE STIRRED VESSELS USING
A 2-D PIV TECHNIQUE
K. Chung, M. Barigou and M. Simmons

A REVIEW OF LINEAR ELECTRICAL TOMOGRAPHY PROBES FOR MONITORING THE
BEHAVIOUR OF MULTIPHASE MIXING PROCESSES
G. Bolton

ELECTROCHEMICAL MEASUREMENT OF IMPELLER SPEED FOR OFF-BOTTOM
SUSPENSION – EFFECT OF ELECTROLYTE PROPERTIES
T. Jirout, J. Moravec and F. Rieger

CFD IN MIXING PROCESSES
LARGE EDDY SIMULATION OF MIXING TIME IN A STIRRED TANK WITH DUAL RUSHTON
TURBINES
Z. Gao, J. Min, J. Smith and R. Thorpe

ASSESSING AERATED BIOREACTOR PERFORMANCE USING CFD
J. Schuetze and J. Hengstler

MULTI-SCALE SIMULATIONS OF STIRRED LIQUID-LIQUID DISPERSIONS
J. Derksen and H.E.A. van den Akker

CFD MODELLING OF LIQUID HOMOGENISATION IN STIRRED TANKS WITH ONE AND
TWO IMPELLERS USING LARGE EDDY SIMULATION
M. Jahoda, M. Mostek, A. Kukuková and V. Machon

CFD SIMULATION OF GAS-LIQUID STIRRED VESSELS
F. Scargiali, A. D’Orazio, F. Grisafi and A. Brucato

EVALUATION OF THE EFFECT OF DIFFERENT SIZE OF ROTATING IMPELLER REGION IN CFD
M. Zadravec, S. Basic and M. Hribersek

SHEAR ANALYSIS OF MIXING REACTORS – VERIFICATION OF THE CFD APPROACH
S. Vlaev, D. Georgiev, I. Nikov and M. Elqotbi
FINITE ELEMENT ANALYSIS OF IMPELLER-INDUCED FLOW IN AN UNBAFFLED VESSEL USING RANS MODELS
D. Hitomi, Y. Kato and H. Sugiyama

CFD SIMULATION OF MULTIPHASE FLOW: CLOSURE RECOMMENDATIONS FOR FLUID-FLUID SYSTEMS
A. Al Taweel, S. Madhavan, K. Podila, M. Koksal, A. Troshko and Y. Gupta

NUMERICAL SIMULATION OF SOLID-LIQUID SUSPENSION IN NEWTONIAN AND POWER LAW LIQUIDS
P. Pianko-Oprych, L. Adams, A. Nienow and M. Barigou

DIRECT NUMERICAL SIMULATION OF THE INTERACTION BETWEEN PARTICLES AND TURBULENCE STRUCTURES IN A STIRRED TANK REACTOR
F. Sbrizzai, V. Lavezzo, R. Verzicco, M. Campolo and A. Soldati

FORMULATION AND VALIDATION OF BIVARIATE POPULATION BALANCE MODELS AND THEIR IMPLEMENTATION IN COMPUTATIONAL FLUID DYNAMICS CODES
D. Marchisio, A. Zucca, M. Vanni, A. Barresi and G. Baldi

MIXING IN CURVED TUBE OF CIRCULAR CROSS-SECTION USING SCALAR TRANSPORT TECHNIQUE
V. Kumar, M. Aggarwal and K. Nigam

DISTINCT ELEMENTS MODELING APPROACH TO MIXING OPERATIONS: MICRO AND MACROMIXING CALCULATION FOR GRANULAR SYSTEMS
O. Ligabue, A. Marchiori and M. Masi

APPLICATIONS OF MIXING TECHNOLOGY

MIXING WITH INTERMITTENT JETS WITH APPLICATION IN HANDLING RADIOACTIVE WASTE SLUDGES
P. Meyer and A. Etchells

TRANSIENT HYDRODYNAMICS OF A STIRRED TANK DURING STOPPING
J.P. Torre, D.F. Fletcher, T. Lasuye and C. Xuereb

DESIGN OF CHEMICAL REACTORS FOR NANO-PARTICLE PRECIPITATION
D. Marchisio, L. Rivautella, E. Gavi, M. Vanni, A. Barresi and G. Baldi

LARGE PADDLE IMPELLER FOR ENHANCING SURFACE AERATION: APPLICATION TO POLYMERIZATION REACTOR WITH LIQUID LEVEL CHANGE

DOUBLE-FEED SEMIBATCH PRECIPITATION - EFFECTS OF MIXING
J. Baldyga, L. Makowski and W. Orciuch

CFD SIMULATION OF GLUCONIC ACID PRODUCTION IN A STIRRED GAS-LIQUID FERMENTER
M. Elqotbi, L. Montastruc, S. Vlaev and I. Nikov

MODELLING OF MIXING EFFECTS ON THE COURSE OF SPRAY-FREEZING PROCESS
M. Henczka and J. Baldyga
VALIDATION OF CFD SIMULATIONS WITH LIF DATA FOR THE SULZER MIXERS SMX AND SMR
S. Hirschberg, P. Mathys and A. Ruetti

USING SCREEN-TYPE STATIC MIXERS TO PROMOTE INTER-PHASE MASS TRANSFER IN LIQUID-LIQUID DISPERSIONS
A. Al Taweel and C. Li

RESIDENCE TIME DISTRIBUTION OF NON-NEWTONIAN LIQUIDS IN STATIC MIXERS
R. Saravanan and K. Tiwari

HEAT TRANSFER TO NON-NEWTONIAN LIQUIDS IN STATIC MIXERS
R. Saravanan and K. Tiwari

NUMERICAL MODELLING OF TURBULENT DROP BREAKAGE IN A KENICS STATIC MIXER AND COMPARISON WITH EXPERIMENTAL DATA
Z. Jaworski, P. Planko-Oprych, D. Marchisio and A. Nienow

EXPERIMENTAL INVESTIGATION OF A VELOCITY FIELD THROUGHOUT STATIC MIXER SMX
M. Hammoudi, E.K. Si-Ahmed, J. Legrand and A. Salem

ANALYSIS OF THE STAGGERED-BAFFLES STATIC MIXER
M. Al-Atabi, S.B. Chin, X.Y. Luo and S.B.M. Beck

PERFORMANCE OF CHAOTIC MIXING CAUSED BY RECIPROCATING A DISK IN A CYLINDRICAL VESSEL
Y. Hirata, T. Dote, T. Yoshioka, Y. Komoda and Y. Inoue

MIXING, FLOW AND CHEMICAL REACTION OF PARTIALLY MISCEBLE COMPONENTS IN MICRO-SCALE CHANNELS
E.B. Nauman and A. Nigam

METHODS FOR THE CHARACTERIZATION AND COMPARISON OF MIXING EFFICIENCY OF DIFFERENT CONFINED OPPOSING JETS MIXING DEVICES
M. Bertrand-Andrieu, E. Plasari and P. Baron

APPLICATION OF ASYMMETRIC IMPELLERS TO MIXING AT UNSTEADY SPEED WITHIN A SINGLE REVOLUTION
Y. Kato, Y. Tada, M. Ban, Y. Nagatsu, S. Hiaraoka and K. Yanagimoto

THE BLENDING EFFICIENCY OF AN INTERMESHING HELICAL RIBBON AND SCREW IMPELLER COMBINATION
S. Koehler, H. Brod and P. Walzel

MIXING CHARACTERISTICS IN A VESSEL AGITATED BY LARGE PADDLE IMPELLER MAXBLEND®
K. Takahashi, H. Horiguchi, M. Mishima and R. Yatomi

ULTRASOUND FOR DISPERSING NANOPARTICLES
C. Sauter, M. Pohl and H. Schuchmann

EXPERIMENTS AND CFD MODELLING OF TURBULENT MASS TRANSFER IN A MIXING CHANNEL
L.K. Hjertager Osenbroch, B.H. Hjertager and T. Solberg
NUMERICAL STUDY ON THE TURBULENT REACTING FLOW IN THE INJECTOR REGION OF AN LDPE TUBULAR REACTOR
E. van Vliet, J. Derksen, H.E.A. van den Akker and R.O. Fox

AN EFFECT OF THE TYPE OF AN ECCENTRICALLY LOCATED IMPELLER ON THE EFFICIENCY OF HEAT TRANSFER PROCESS
J. Karcz and M. Cudak

LARGE-SCALE STRUCTURE OF THE LIQUID-PHASE MOTION OF THE FULLY DEVELOPED TURBULENT BUBBLY FLOWS IN A LARGE-DIAMETER PIPE
S. Urano, Y. Ochiai, M. Ishitobi and T. Saito

FOUNDATIONS OF MIXING THEORY FOR MICROFLOW DEVICES
M. Giona, F. Garofalo, S. Cerbelli, A. Adrover and F. Creta

MIXING BEHAVIOR AND LOCAL MIXING TIMES IN TAYLOR-COUETTE FLOW
A. Racina and M. Kind

EFFECT OF SURFACTANT ON THE MOTION OF A SINGLE RISING BUBBLE
K. Sakakibara, Y. Miyamoto and T. Saito

MODELLING THE DOSE DISTRIBUTION FUNCTION IN A HELICAL FLOW PHOTOLYTIC REACTOR FOR VIRUS INACTIVATION BY UV-C IRRADIATION
H. Brod

Author Index