

# CHEMICAL PRODUCT AND PROCESS MODELING

## EDITORS-IN-CHIEF

*Rahmat Sotudeh-Gharebagh*, University of Tehran, Iran

*Navid Mostoufi*, University of Tehran, Iran

*Jamal Chaouki*, Ecole Polytechnique de Montreal, Canada

## ASSOCIATE EDITORS

*Ricardo Aguilar-López*, CINVESTAV-IPN, México

*Sameer Al-Asheh*, Jordan University of Science and Technology, Jordan

*Adel Al-Taweel*, Dalhousie University, Canada

*Costin Sorin Bildea*, University Politehnica of Bucharest, Romania

*Miryan Cassanello*, Universidad de Buenos Aires, Argentina

*Alkis Constantinides*, Rutgers, State University of New Jersey, USA

*Marc-Olivier Coppens*, University College London, UK

*Mario R. Eden*, Auburn University, USA

*Eugénio C. Ferreira*, Universidade do Minho, Portugal

*Iftikhar Karimi*, National University of Singapore, Singapore

*Eugeny Kenig*, University of Paderborn, Germany

*Jiri Klemes*, University of Pannonia, Hungary

*Andrzej Kraslawski*, University of Lappeenranta, Finland

*Surendra Kumar*, Indian Institute of Technology Roorkee, India

*Jae W. Lee*, The City College of New York, USA

*Patrick Linke*, Texas A&M University at Qatar, Qatar

*Norman W. Loney*, New Jersey Institute of Technology, USA

*Davide Manca*, Politecnico di Milano, Italy

*Mark Nelson*, University of Wollongong, Australia

*Heinz A. Preisig*, Norwegian University of Science and Technology, Norway

*Fernando Preto*, CANMET Energy Technology Centre, Canada

*Todd Pugsley*, University of Saskatchewan, Canada

*Luis Puigjaner*, Universitat Politècnica de Catalunya, Spain

*Jean-Michel Reneaume*, Ecole Nationale Supérieure en Génie des Technologies Industrielles, ENSGTI, France

*Sohrab Rohani*, University of Western Ontario, Canada

*Panos Seferlis*, Aristotle University of Thessaloniki and Centre for Research and Technology, Greece

*Paul Stuart*, Ecole Polytechnique de Montreal, Canada

*Bill Svrcek*, University of Calgary, Canada

*Jan Verstraete*, IFP Energies nouvelles, France

*Johan Warna*, Abo Akademi University, Finland

*Joachim Werther*, Technical University Hamburg, Germany

*Brent Young*, University of Auckland, New Zealand

*Yifang Zhu*, UCLA School of Public Health, USA

DE GRUYTER

**CHEMICAL PRODUCT AND PROCESS MODELING (CPPM)** is the premier forum for theoretical and applied research on product and process modeling, simulation and optimization. Thanks to its international editorial board, the journal assembles the best papers from around the world on modern modeling, simulation and optimization techniques and it also covers the gap between product and process. The range of topics includes equation-oriented modeling and simulation, sequential and modular simulation, performance of industrial process simulators, computational fluid dynamics, environmental, food, pharmaceutical and fine chemical process modeling. The journal brings together chemical engineering researchers, practitioners, and software developers in a new forum for the international modeling and simulation community. Editors represent top engineering institutions across the globe, such as the University of Tehran, the Ecole Polytechnique de Montreal, Rutgers, Indian Institute of Technology, the Technical University Hamburg, and the University of Buenos Aires.

**ABSTRACTED/INDEXED IN** Celdes · CNKI Scholar (China National Knowledge Infrastructure) · CNPIEC · EBSCO Discovery Service · Elsevier: Compendex; Engineering Village; SCOPUS · Google Scholar · Inspec · J-Gate · Naviga (Softweco) · Polymer Library · Primo Central (ExLibris) · ProQuest: Advanced Technologies Database with Aerospace; Aerospace Database; Aluminium Industry Abstracts; ANTE: Abstracts in New Technologies and Engineering; Ceramic Abstracts/World Ceramics Abstracts; Civil Engineering Abstracts; Computer and Information Systems Abstracts; Copper Technical Reference Library; Corrosion Abstracts; Earthquake Engineering Abstracts; Electronics and Communications Abstracts; Engineered Materials Abstracts; Engineering Research Database; Materials Business File; Materials Research Database; Mechanical & Transportation Engineering Abstracts; METADEX (Metals Abstracts); Solid State and Superconductivity Abstracts; Technology Research Database · SCImago (SJR) · Summon (Serials Solutions/ProQuest) · TDOne (TDNet) · WorldCat (OCLC)

The publisher, together with the authors and editors, has taken great pains to ensure that all information presented in this work (programs, applications, amounts, dosages, etc.) reflects the standard of knowledge at the time of publication. Despite careful manuscript preparation and proof correction, errors can nevertheless occur. Authors, editors and publisher disclaim all responsibility for any errors or omissions or liability for the results obtained from use of the information, or parts thereof, contained in this work.

The citation of registered names, trade names, trademarks, etc. in this work does not imply, even in the absence of a specific statement, that such names are exempt from laws and regulations protecting trademarks etc. and therefore free for general use.

ISSN 2194-6159 · e-ISSN 1934-2659

All information regarding notes for contributors, subscriptions, Open Access, back volumes and orders is available online at [www.degruyter.com/cppm](http://www.degruyter.com/cppm).

**RESPONSIBLE EDITOR** Rahmat Sotudeh-Gharebagh, Department of Chemical Engineering, College of Engineering, University of Tehran, P.O. Box 11155-4563, Tehran, Iran.  
Email: [sotudeh@ut.ac.ir](mailto:sotudeh@ut.ac.ir)

**JOURNAL MANAGER** Theresa Haney, De Gruyter, Genthiner Straße 13, 10785 Berlin, Germany.  
Tel.: +49 (0)30 260 05-375, Fax: +49 (0)30 260 05-325,  
Email: [theresa.haney@degruyter.com](mailto:theresa.haney@degruyter.com)

**RESPONSIBLE FOR ADVERTISEMENTS** Claudia Neumann, De Gruyter, Genthiner Straße 13, 10785 Berlin, Germany,  
Tel.: +49 (0)30 260 05-226, Fax: +49 (0)30 260 05-264,  
E-mail: [anzeigen@degruyter.com](mailto:anzeigen@degruyter.com)

© 2016 Walter de Gruyter GmbH, Berlin/Boston

**TYPESETTING** Integra Software Services Pvt. Ltd., Pondicherry, India

**PRINTING** Franz X. Stickle Druck und Verlag e.K., Ettenheim  
Printed in Germany

**COVER ILLUSTRATION** Chad Baker, Ryan McVay/Photodisc/Thinkstock



## Contents

### Research Articles

Woon Phui Law, Wan Hanisah Wan Ibrahim  
and Jolius Gimbun

**Modeling of Methyl Methacrylate Polymerization Using  
MATLAB — 185**

J. Suhana and M. Rashid

**Evaluation of Radiological Hazards of Particulates  
Emissions From a Coal Fired Power Plant — 197**

Jolius Gimbun, Shi Yan Liew, Zoltan K. Nagy  
and Chris D. Rielly

**Three-Way Coupling Simulation of a Gas-Liquid Stirred  
Tank using a Multi-Compartment Population Balance  
Model — 205**

Ali Hedayati and S. M. Ghoreishi

**Artificial Neural Network and Adaptive Neuro-Fuzzy  
Interface System Modeling of Supercritical CO<sub>2</sub>  
Extraction of Glycyrrhizic Acid from *Glycyrrhiza  
glabra L.* — 217**

Ali Motevali, Reza Amiri Chayjan, Kamran Salari  
and Ahmad Taghizadeh

**Studying the Effect of Different Drying Bed on Drying  
Characteristic of Mint Leaves — 231**

Shubham Mehta, Harish Ramani, Nileshekumar N. Yelgatte  
and Imran Rahman

**Recursive Orthogonal Least Square Based Soft Sensor  
for Batch Distillation — 241**