

Mohsen Karimi

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SUMMARY STATEMENT

Researcher in Computational Fluid Dynamics with a passion for programming and multiphase systems. Over eight years of experience developing and applying CFD models for a range of problems in chemical engineering and mineral processing fields.

EDUCATION AND RESEARCH EXPERIENCE

EDUCATION

Department of Applied Science and Technology,
Politecnico di Torino
Post-doctoral Research Fellow
Supervisor: Daniele L. Marchisio

Turin, Italy
February 2014 - Present

Process Engineering Department,
University of Stellenbosch
Ph.D. in Extractive Metallurgical Engineering
Dissertation: "CFD Analysis of Solid-Liquid-Gas
Interactions in Flotation Vessels"
Advisors: Guven Akdogan, Steven M. Bradshaw

Stellenbosch, South Africa
December 2013

Faculty of Mining and Metallurgical Engineering,
Yazd University
M. Sc. in Mineral Processing
Thesis: "CFD Modelling and Evaluating the Effects
of Operational Parameters on the Performance of Hydrocyclones"
Advisors: Ali Dehghani, Shahram Talebi

Yazd, Iran
October 2009

Faculty of Mining Engineering,
Kashan University
B. Sc. in Mining Engineering

Kashan, Iran
June 2006

RESEARCH INTERESTS

Application of CFD for different engineering fields; formulations and developments of CFD solvers for single and multiphase systems; fundamental studies towards establishing new modelling methodologies for a range of engineering problems encountered in the chemical, mechanical, process and mining engineering;

RESEARCH EXPERIENCE

Postdoctoral Fellowship

2014 - Present

Working with Professor Marchisio on "Modelling of Morphology Development of Micro and Nano Structures ([MoDeNa](#))" project aiming to develop, demonstrate and evaluate a CFD-PBE model for polyurethane foams.

- Formulating a novel approach based on population balance equation for the simulation of polyurethane foams.
- Developing and validating a zero-dimensional framework for simulation of reacting expanding polyurethane foams, ([source code](#)).
- Introducing a new solver, “PUFoam”, in OpenFOAM CFD code, based on coupling of PBE with CFD.
- Providing guidance and mentorship to post graduate students in “multiscale modelling for materials science and process engineering research group”:
 - Hermes Droghetti; “*Development of an OpenFOAM solver for polyurethane foams*”.
 - Marco Cravero; “*Testing and validation of a computational fluid dynamics model for polyurethane foams*”.
 - Alessandro Concas; “*Modeling of polyurethane foams with commercial CFD code FLU-ENT*”.

Doctoral Research

2010 - 2014

Worked with Professor Akdogan and Professor Bradshaw on the development of a CFD model for conventional flotation vessels. A CFD-based methodology was formulated, and validated for the prediction of flotation macro response by integrating the significance of the hydrodynamic flow features into the flotation micro-processes.

Master’s Research

2007 - 2009

Worked with Professor Dehghani and Professor Talebi on experimental, analytical and computational modelling of hydrocyclones.

PUBLICATIONS

REFEREED JOURNAL PAPERS

1. M. Karimi, H. Droghetti, D. L. Marchisio, “PUFoam: a novel open-source CFD solver for the simulation of expanding and reacting polyurethane foams”, submitted to *Computer Physics Communications*, July 2016.
2. P. Ferkl, M. Karimi, D. L. Marchisio, J. Kosek, “Multi-scale modelling of expanding polyurethane foams: coupling macro- and bubble-scales”, *Chemical Engineering Science*, Vol. 148, pp. 55–64, 2016.
3. M. Karimi, H. Droghetti, D. L. Marchisio, “Multiscale Modelling of Expanding Polyurethane Foams via Computational Fluid Dynamics and Population Balance Equation”, *Macromolecular Symposia*, Vol. 360(1), pp. 108–122, 2016.
4. M. Karimi, D. L. Marchisio, “A Baseline Model for the Simulation of Polyurethane Foams via the Population Balance Equation”, *Macromolecular Theory and Simulations*, Vol. 24(4), pp. 291–300, 2015.
5. M. Karimi, G. Akdogan, S. M. Bradshaw, “A Computational Fluid Dynamics Model for the Flotation Rate Constant, Part I: Model Development”, *Minerals Engineering*, Vol. 69, pp. 214–222, 2014.
6. M. Karimi, G. Akdogan, S. M. Bradshaw, “A CFD-Kinetic Model for the Flotation Rate Constant, Part II: Model Validation”, *Minerals Engineering*, Vol. 69, pp. 205–213, 2014.
7. M. Karimi, G. Akdogan, K. H. Dellimore, S. M. Bradshaw, “Quantification of Numerical Uncertainty in Computational Fluid Dynamics Modelling of Hydrocyclones”, *Computer & Chemical Engineering*, Vol. 43, pp. 45–54, 2012.
8. M. Karimi, G. Akdogan, S. M. Bradshaw, “Effects of Different Mesh Schemes and Turbulence Models in CFD Modelling of Stirred Tanks”, *Physicochemical Problems of Mineral Processing*, Vol. 48(2), pp. 513–531, 2012.
9. A. Ghaffari, M. Karimi, “Numerical Investigation on Multiphase Flow Simulation in a Centrifugal Flotation Cell”, *International Journal of Coal Preparation and Utilization*, Vol. 32(3), pp. 120–129, 2012.
10. M. Karimi, G. Akdogan, A. Dehghani, S. M. Bradshaw, “Selection of Suitable Turbulence Models for Numerical Modelling of Hydrocyclones”, *Chemical Product and Process Modelling*, Vol. 6(1), 2011.
11. M. Karimi, A. Dehghani, A. Nezamalhosseni, S. Talebi, “Prediction of Hydrocyclone Performance Using Artificial Neural Networks”, *The Journal of South African Institute of Mining and Metallurgy*, Vol. 110, pp. 207–212, 2010.

CONFERENCE PROCEEDINGS

12. M. Karimi, P. Ferkl, D. L. Marchisio, J. Kosek, H. Droghetti, "Coupling of a macro-scale CFD model with a bubble-scale model for simulation of polyurethane foams", to be presented at the *22nd International Congress of Chemical and Process Engineering, CHISA*, Prague, Czech Republic, August 28-31, 2016.
13. M. Karimi, D. L. Marchisio, "Coupling Population Balance Equation (PBE) with Computational Fluid Dynamics (CFD) for Multiphase Modelling of Expanding Polyurethane Foams", *In: Proceedings of the 9th International Conference on Multiphase Flow*, Firenze, Italy, May 22-27, 2016.
14. P. Ferkl, M. Karimi, D. L. Marchisio, J. Kosek, "Introducing a Multiscale modelling tool for the Simulation of Polyurethane Foams", *In: Proceedings of the 9th International Conference on Multiphase Flow*, Firenze, Italy, May 22-27, 2016.
15. M. Karimi, D. L. Marchisio, "Validation of a Macro-Scale CFD-PBE Model for the Polyurethane Foaming Process", *In: Proceedings of the AIChE 2015 Annual Meeting*, Salt Lake City, UT, USA, November 8-13, 2015.
16. M. Karimi, G. Akdogan, S. M. Bradshaw, "A CFD Model for the Flotation Rate Constant", *In: Proceedings of the 37th International Symposium Application of Computers and Operations Research in the Mineral Industry (APCOM)*, pp. 445-456, May 23-27, 2015.
17. M. Karimi, D. L. Marchisio, "Multi-scale Modelling of a Reacting-Expanding Polyurethane Foam", *10th European Congress of Chemical Engineering*, Nice, France, September 27 to October 1, 2015.
18. M. Karimi, D. L. Marchisio, "Multiscale Modelling of Expanding Polyurethane Foams via Computational Fluid Dynamics and Population Balance Model", *In: Proceedings of Polymer Reaction Engineering IX (PRE9)*, Cancun, Mexico, May 10-15, 2015.
19. M. Karimi, G. Akdogan, K. Dellimore, S. M. Bradshaw, "Comparison of Different Drag Coefficients in CFD Modelling of a Laboratory Scale Rushton-Turbine Flotation Tank", *In: Proceedings of the Ninth International Conference on CFD in the Minerals and Process Industries*, CSIRO, Melbourne, Australia, December 10-12, 2012.
20. M. Karimi, G. Akdogan, K. Dellimore, S. M. Bradshaw, "Quantification of Numerical and Model Uncertainties in the CFD Simulation of the Gas Holdup and Flow Dynamics in a Laboratory Scale Rushton-turbine Flotation Tank", *In: Proceedings of the Ninth International Conference on CFD in the Minerals and Process Industries*, CSIRO, Melbourne, Australia, December 10-12, 2012.
21. M. Karimi, G. Akdogan, S. M. Bradshaw, A. Mainza, "Numerical Modelling of Air Core in Hydrocyclones", *In: Proceedings of the Ninth International Conference on CFD in the Minerals and Process Industries*, CSIRO, Melbourne, Australia, December 10-12, 2012.
22. M. Karimi, G. Akdogan, S. M. Bradshaw, "CFD Simulation of a Mechanically Stirred Tank using Multiple Reference Frames Technique", *MINPRO 2011 South African Institute of Mining & Metallurgy*, Western Cape Branch, Cape Town, South Africa, 2011.
23. M. Karimi, G. Akdogan, S. M. Bradshaw, "Comparison of Various Turbulence Models for CFD Simulation of Hydrocyclones", *MINPRO 2011 South African Institute of Mining & Metallurgy*, Western Cape Branch, Cape Town, South Africa, 2011.

PROFESSIONAL DEVELOPMENT

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- Advanced workshop on multi-scale modelling of flowing soft matter and polymer systems, International Center for Mechanical Science (CISM), Udine, Italy, July 2016.
 - OpenFOAM: Programming CFD, Training workshop, CFD Direct Limited, April 2016.
 - *MoDeNa* technical workshop on the quantum, molecular and meso-scale modelling, University of Stuttgart, Stuttgart, Germany, Feb 2015.
 - *MoDeNa* technical workshop on the production of polyurethane foams, Lemförde, Germany, Feb 2014.
 - Grant Writing Workshop, Division for Research Development, Stellenbosch University, April 2012.
 - A Strategic Plan and Approach for the Launching of a Successful Article to an Accredited Journal, Division for Research Development, Stellenbosch University, April 2012.

AWARDS AND HONOURS

- South African Minerals to Metals Research Institute (SAMMRI), Scholarship Recipient, 2013.
- OUTOTEC Travel Grant Recipient, 2012.
- PGIO Overseas Conference Grant Recipient, 2012.
- OSP Scholarship Recipient, 2011 and 2010.
- First Grade Graduate of Yazd University, 2010.

SKILLS

Pre-processing: Proficient in Design Modeller and GAMBIT.
CFD codes: Proficient in OpenFOAM and Fluent.
Post-processing: Proficient in CFD-Post and paraView, familiar with Tecplot 360.
Programming: Proficient in C++, experienced with Python and MATLAB.
Design of Experiments: Proficient in Design Expert, MiniTab, Qualitek.
Mineral processing tools: Experienced with MODSIM, familiar with JKSimMet.

REFERENCES

- Guven Akdogan (gakdogan@sun.ac.za), Associate Professor, Department of Process Engineering, Stellenbosch University, Stellenbosch, South Africa.
- Daniele L. Marchisio (daniele.marchisio@polito.it), Associate Professor, Department of Applied Science and Technology, Politecnico di Torino, Turin, Italy.
- Steven M. Bradshaw (smb@sun.ac.za), Professor, Department of Process Engineering, Stellenbosch University, Stellenbosch, South Africa.
- Ali Dehghani, (a.dehghani@yazduni.ac.ir), Associate Professor, Faculty of Mining and Metallurgical Engineering, Yazd University, Yazd, Iran.