SAJJAD FOROUGHI

Research Associate, Imperial College London

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PROFILE

- Expert in numerical modelling of multi-phase flow in porous media, pore- and continuum-scale dynamic multi-phase flow and transport simulation, numerical simulation.
- Extensive skill in Computer programming, optimisation, sensitivity analysis, machine learning, and analytical modelling with the objective of applying them to pore-scale modelling
- Leads the modelling activity in research group, supervising PhD and MSc students and collaborating with researchers. Proven track record of collaboration with scientists both at Imperial College London and globally.
- Experienced in project management, team work, and acts as an interface between numerical models and experimental laboratories.

ACADEMIC EMPLOYMENT

Feb 2019–Present: Imperial College Research Associate
Department of Earth Science and Engineering, Imperial College London
Development of novel codes for modeling multi-phase flow on micro-CT images of porous media (including rocks, fuel cells, and soil). Also, developing toolboxes for the analysis of captured micro-CT images.

- Published 21 manuscripts in journals such as PRE, TiPM, Chem Eng Sci, Adv Water Resour, SPEJ, GRL, Energy Fuels, AIChE, Journal of Power Sources. Seven are currently under review, including International Journal of Hydrogen Storage, Chem Eng Sci, and Adv Water Resour, and five are in preparation for 2023 submission, including Physical Review Letters, GRL, WRR, and Adv Water Resour.
- Delivered 10 invited conference talks and seminars, including InterPore, CMWR, and GRC.
- Mentored MSc and PhD students.
- Collaborative network: Established collaborations with universities around the globe and in the UK.

EDUCATION

Sep 2012–Sep 2018: PhD Petroleum Engineering
Chemical & Petroleum Engineering Department, Sharif University of Technology,
Thesis: “Simulation of Two-phase Flow Through Micro-fractured Rocks Using Multi-block Lattice Boltzmann Method”
GPA (Cumulative): 18.55/20

Sep 2009–Sep 2011: MSc Chemical Engineering
Chemical & Petroleum Engineering Department, Sharif University of Technology,
Thesis: “Lattice Boltzmann Simulation of Fluid Flow through Porous Media Using Local Grid Refinement”
GPA (Cumulative): 17.63/20

Sep 2005–Jul 2009: BSc Petroleum Reservoir Engineering
Petroleum University of Technology
Thesis: “Foamy Oil Flow through Porous Media”
GPA (Cumulative): 17.51/20

HONORS & AWARDS

- Ranked 4 in PhD Nationwide Entrance Examination in Petroleum Engineering, 2012.
- Ranked 2 in MSc Nationwide Entrance Examination in Petroleum Engineering, 2009.
- Ranked 1066 (top 0.3%, Regional 45) among more than 367000 participant in Iranian University Entrance Exam (Konkour), 2005.
- Best PhD Research Student at Chemical and Petroleum Engineering Department of Sharif University of Technology, Sep 2017.
- Honorary Member of the "Iranian National Foundation of Elites" 2015.
- Awarded the Scholarship (Fellowship) for B.Sc. in Petroleum Engineering from Petroleum University of Technology, 2005-2009.
- Offered Admission to the M.Sc. Program in Petroleum Engineering from Petroleum University of Technology, 2009.

INDUSTRIAL POSITION

Sep 2011–Feb 2019: MAPSA Technology Center (MTC), Technical Programmer

An Iranian software development centre engaged in the development of petroleum engineering related software applications.

- Part-time technical programmer, Mud Logging software, Sep 2011–Jun 2013.
- Part-time technical programmer, PVT Pro software, Jun 2012–Feb 2019.

Jul 2012–Jul 2014: Developing a general smart framework; Integrated reservoir engineering optimisation aimed to optimise the technical-economical decisions for Iranian South Pars Gas Field.

TECHNICAL SKILLS

Programming: Professional programmer with more than 12 years of experience in developing codes by **C++, Python, MATLAB, C#, FORTRAN.**

TEACHING EXPERIENCE

- Graduate Teaching Assistant for Advanced Fluid flow through Porous Media, Sharif University of Technology, under Supervision of Dr. M. H. Ghazanfari Email (autumn 2012 and 2013).
- Graduate Teaching Assistant for Computational Fluid Dynamics, Sharif University of Technology, under Supervision of Dr. M. R. Pishvaie Email (Spring 2015 and 2016).
- Teaching Assistant for Drilling Engineering Lab, Sharif University of Technology, under Supervision of Dr. S. Jamshidi for 4 semesters (2012 - 2014) Email.
- Co-supervising PhD and MSc students at Imperial College London.

SELECTED PUBLICATIONS

- **Sajjad Foroughi**, Branko Bijeljic, and Martin J. Blunt. "Incorporation of Sub-Resolution Porosity into Two-Phase Flow Models with a Multiscale Pore Network" under review in Water Resources Research, Link.
- **Sajjad Foroughi**, Branko Bijeljic, Qingyang Lin, Ali Q. Raeini, and Martin J. Blunt. "Pore-by-pore modeling, analysis, and prediction of two-phase flow in mixed-wet rocks." Physical Review E 102, no. 2 (2020): 023302, Link.

- **Sajjad Foroughi**, Branko Bijeljic, and Martin J. Blunt. "A closed-form equation for capillary pressure in porous media for all wettabilities." Transport in Porous Media 145.3 (2022): 683-696, Link.
- **Sajjad Foroughi**, Saeid Jamshidi, and Mahmoud Reza Pishvaie. "New Correlative models to improve prediction of fracture permeability and inertial resistance coefficient." Transport in Porous Media 121, no. 3 (2018): 557-584, Link.

PUBLICATIONS

- Selem, Ahmed M., Nicolas Agenet, **Sajjad Foroughi**, Martin J. Blunt, and Branko Bijeljic. "Pore-Scale Imaging of Emulsification of Oil during Tertiary and Secondary Low Salinity Waterflooding in a Reservoir Carbonate." Energy Fuels (2023), Link.
- **Sajjad Foroughi**, Branko Bijeljic, Ying Gao, and Martin J. Blunt. "Incorporation of Sub-Resolution Porosity into Two-Phase Flow Models with a Multiscale Pore Network" under review in Water Resources Research, Link.
- Li, Min, **Sajjad Foroughi**, Jiafei Zhao, Branko Bijeljic, and Martin J Blunt. "Image-Based Pore-Scale Modelling of the Effect of Wettability on Breakthrough Capillary Pressure in Gas Diffusion Layers."Journal of Power Sources, Link.
- Ming-Liang Qu, Martin J. Blunt, Xiaolei Fan, **Sajjad Foroughi**, Zi-Tao Yu, Qingyang Lin. "Pore-to-mesoscale network modelling of heat transfer and fluid flow in packed beds with application to process design", AICHE Journal (2023), e18213. Link
- Ramin Moghadasi, **Sajjad Foroughi**, Farzad Basirat, Steven McDougall, Branko Bijeljic, Martin J Blunt, Alexandru Tatomir, Auli Niemi, "Pore-scale determination of residual gas remobilization and critical saturation in geological CO2 storage: A pore-network modelling approach", Water Resources Research, (2023), e2022WR033686. Link
- Yihuai Zhang, Branko Bijeljic, Ying Gao, Sepideh Goodarzi, **Sajjad Foroughi**, Martin J Blunt, "Pore-scale observations of hydrogen trapping and migration in porous rock: demonstrating the effect of Ostwald ripening", Geophysical Research Letters (2023), e2022GL102383. Link
- Guanglei Zhang, **Sajjad Foroughi**, Branko Bijeljic, Martin J Blunt. "A Method to Correct Steady-state Relative Permeability Measurements for Inhomogeneous Saturation Profiles in One-dimensional Flow." Transport in Porous Media (2023). Link
- Abdulla Alhosani, Ahmed Selem, **Sajjad Foroughi**, Branko Bijeljic, and Martin J. Blunt. "Steady-State Three-Phase Flow in a Mixed-Wet Porous Medium: A Pore-Scale X-ray Microtomography Study." Advances in Water Resources (2023): 104382, Link.
- Guanglei Zhang, **Sajjad Foroughi**, Ali Q. Raeini, Martin J. Blunt, and Branko Bijeljic. "The impact of bimodal pore size distribution and wettability on relative permeability and capillary pressure in a microporous limestone with uncertainty quantification." Advances in Water Resources (2022): 104352. Link
- Gloire Imani, Lei Zhang, Martin J. Blunt, **Sajjad Foroughi**, Munezero Ntibahanana, Hai Sun, and Jun Yao. "Three-Dimensional Simulation of Droplet Dynamics in a Fractionally-Wet Constricted Channel." Advances in Water Resources (2022): 104341. Link
- Sanchay Mukherjee, Russell T. Johns, **Sajjad Foroughi**, and Martin J. Blunt. "Fluid–Fluid Interfacial Area and Its Impact on Relative Permeability-A Pore Network Modeling Study." In SPE Journal (2022): 1-11(SPE-209445-PA). Link
- **Sajjad Foroughi**, Branko Bijeljic, and Martin J. Blunt. "A closed-form equation for capillary pressure in porous media for all wettabilities." Transport in Porous Media 145.3 (2022): 683-696, Link.

- Qu, Ming-Liang, Sheng-Yue Lu, Qingyang Lin, **Sajjad Foroughi**, Zi-Tao Yu, and Martin J. Blunt. "Characterization of Water Transport in Porous Building Materials Based on an Analytical Spontaneous Imbibition Model." Transport in Porous Media (2022): 1-16, Link.
- **Sajjad Foroughi**, Branko Bijeljic, and Martin J. Blunt. "Pore-by-Pore Modelling, Validation and Prediction of Waterflooding in Oil-Wet Rocks Using Dynamic Synchrotron Data." Transport in Porous Media 138, no. 2 (2021): 285-308, Link.
- Lin, Qingyang, Branko Bijeljic, **Sajjad Foroughi**, Steffen Berg, and Martin J. Blunt. "Pore-scale imaging of displacement patterns in an altered-wettability carbonate." Chemical Engineering Science 235 (2021): 116464, Link.
- Alhosani, Abdulla, Alessio Scanziani, Qingyang Lin, **Sajjad Foroughi**, Amer M. Alhammadi, Martin J. Blunt, and Branko Bijeljic. "Dynamics of water injection in an oil-wet reservoir rock at subsurface conditions: Invasion patterns and pore-filling events." Physical Review E 102, no. 2 (2020): 023110, Link.
- **Sajjad Foroughi**, Branko Bijeljic, Qingyang Lin, Ali Q. Raeini, and Martin J. Blunt. "Pore-by-pore modeling, analysis, and prediction of two-phase flow in mixed-wet rocks." Physical Review E 102, no. 2 (2020): 023302, Link.
- Mehrdad Vasheghani Farahani, **Sajjad Foroughi**, Sevda Norouzi, and Saeid Jamshidi. "Mechanistic study of fines migration in porous media using lattice Boltzmann method coupled with rigid body physics engine." Journal of Energy Resources Technology 141, no. 12 (2019), Link.
- **Sajjad Foroughi**, Davood Khoozan, and Saeid Jamshidi. "Optimal distribution function determination for plus fraction splitting." The Canadian Journal of Chemical Engineering 97, no. 10 (2019): 2752-2764, Link.
- **Sajjad Foroughi**, Saeid Jamshidi, and Mahmoud Reza Pishvaie. "New Correlative models to improve prediction of fracture permeability and inertial resistance coefficient." Transport in Porous Media 121, no. 3 (2018): 557-584, Link.
- **Sajjad Foroughi**, Mohsen Masihi, Saeid Jamshidi, and Mahmoud Reza Pishvaie. "Investigating the permeability–porosity relation of percolation-based porous media using the lattice Boltzmann method." Journal of Porous Media 20, no. 10 (2017), Link.
- Morshedi, S., **Sajjad Foroughi**, and M. S. Beiranvand. "Numerical simulation of surfactant flooding in Darcy scale flow." Petroleum science and technology 32, no. 11 (2014): 1365-1374, Link.
- **Sajjad Foroughi**, Saeid Jamshidi, and Mohsen Masihi. "Lattice Boltzmann method on quadtree grids for simulating fluid flow through porous media: a new automatic algorithm." Physica A: Statistical Mechanics and its Applications 392, no. 20 (2013): 4772-4786, Link.

CONFERENCES

- Morshedi, S., **Sajjad Foroughi**, S., Tokaman, M., and Ghazanfari, M.H., "Core Scale Numerical Modelling of Surfactant Flooding for Enhanced Oil Recovery from Oil Reservoirs", The 7^{th} International Chemical Engineering Congress Exhibition, Kish, Iran, 21-24 November, 2011.
- **Sajjad Foroughi**, Jamshidi, S., and Pishvaie, M.R. "Pore Scale Simulation of Fluid Flow in an Synthetic Porous Medium using Lattice Boltzmann Method", the 5^{th} National Conference on CFD Applications in the Chemical and Petroleum Industries, Iran University of Science & Technology, Tehran, Iran, 2014.
- **Sajjad Foroughi**, Jamshidi, S., and Pishvaie, M.R. "Simulation of the Interaction between Two Fluids in the Presence of Solid and Controlling Wettability using Multi-component Multiphase Lattice Boltzmann Method", the 5^{th} National Conference on CFD Applications in the Chemical and Petroleum Industries, Iran University of Science & Technology, Tehran, Iran, 2014.
- Rahimi, M. A., Farahani, M. V., **Sajjad Foroughi**, and Jamshidi, S., "Modeling the effect of interparticle forces and surface adhesion force on phase separation of wet phase from nonwet phases in a porous medium using the SC LBM", the 6^{th} National Conference on CFD Applications in the Chemical and Petroleum Industries, University of Kashan, Kashan, Iran, 2015.
- **Sajjad Foroughi**, Jamshidi, S., and Pishvaie, M.R. "Simulation of Fluid Flow through Rock Fractures using Lattice Boltzmann Method", the Second National Conference of Oil and Gas Fields' Development, Sharif University of Technology, Tehran, Iran, 2017.
- **Sajjad Foroughi**, Bijeljic, B., and Martin J Blunt, "Pore-by-pore modeling, calibration, and prediction of two-phase flow in mixed-wet rocks.", IterPore, 13^{th} Annual meeting (Online), 31 May - 04 June 2021.
- Sanchay Mukherjee, Russell T Johns, **Sajjad Foroughi**, Martin J Blunt, "Fluid–Fluid Interfacial Area and Its Impact on Relative Permeability-A Pore Network Modeling Study." SPE Improved Oil Recovery Conference. OnePetro, 2022.
- **Sajjad Foroughi**, Bijeljic, B., and Martin J Blunt. "Predictive multi-scale network models with microporosity.", IterPore, 2022, 14^{th} Annual meeting (Hybrid), 30 May - 02 June 2022.
- **Sajjad Foroughi**, Bijeljic, B., and Martin J Blunt. "Incorporating sub-resolution porosity using multiscale network models for multi-phase flow modelling.", The XXIV International Conference on Computational Methods in Water Resources (CMWR), 2022, 19-23 June 2022, Gdańsk, Poland.
- **Sajjad Foroughi**, Gao, Y., Bijeljic, B., and Martin J Blunt. "Multi-scale pore network model for simulation of multi-phase flow in heterogeneous porous media.", IterPore, 2023, 15^{th} Annual meeting (Hybrid), 22 May - 27 May 2023.