

Shen Li (Dr.)

Curriculum Vitae

Affiliation:

Department of Mechanical Engineering, Imperial College London, London, SW7 2AZ, United Kingdom

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Employment

Postdoctoral Research Associate, Imperial College London, UK **2018.7~present**

Department of Mechanical Engineering

Advisor: Prof. Gregory Offer and Dr. Monica Marinescu

Technical Consultant, Imperial Consultants (ICON) **2021.3~2021.7**

Working for one of UK's leading companies on renewable energy (company name not shown for confidential reason)

Qualifications

Ph. D., Tsinghua University, China **2013.9~2018.6**

Institute of Solid Mechanics, School of Aerospace Engineering

Advisor: Prof. Qunyang Li

Co-advisor: Prof. Xi-Qiao Feng

B. Sc., China University of Mining and Technology, China **2009.9~2013.9**

Department of Engineering Mechanics

Research Experiences

➤ **Energy Storage**

Lithium-ion battery is the most realistic energy storage solution until now, and there is a strong need to improve lithium-ion batteries performances for space engineering. In this project, my research includes parametrization of electrical and thermal behaviors of lithium-ion batteries, electrical-thermal-degradation coupled modelling, cell design and thermal management strategies for renewable energy for space engineering.

➤ **Energy Dissipation**

As key aspect of system energy dissipation, the dynamic sliding behavior of contacting solid interface is studied. In this project, I measured the frictional ageing parameters that dominate the energy dissipation mode and a pronounced scale effect was discovered and explained. The discovered scaling effect is influential to deeper exploration into energy dissipation of various frictional systems, ranging from nanoelectromechanical devices to earthquakes.

Energy storage: Lithium-ion battery modelling

➤ **Solid mechanics**

Solid interfaces are universal, and their mechanical behaviors are dominated by contact properties such as contact stiffness, real contact area, and load. In this project, the influence of

elastic interaction on those fundamental indexes were revealed through experiment and modelling study. This fundamental study is relevant to a wide range of applications such as the structure deformation in space engineering.

Skills

Coding and simulation skills: Python, MATLAB, C++, Finite Element simulation (ABAQUS, ANSYS), Molecular Dynamic simulation, industrial cast simulation

Laboratory: Atomic Force Microscopy (AFM), Scanning Electron Microscopy (SEM), Nano-tribometer, Nano-indentation, Mechanical test instrument, High-temperature furnace

Teaching and supervision experiences

Graduate teaching assistant (GTA) for Mathematics, Dept. Mechanical Engineering, Imperial College London (2019.9-2020.6)

Responsibilities included: leading study groups, tutorials, marking final tests, problem feedback

Graduate teaching assistant (GTA) for Engineering Mechanics, Dept. Engineering Mechanics, Tsinghua University (2016.11-2017.2)

Responsibilities included: leading study groups, tutorials, marking progress tests, problem feedback

Co-supervising research assistant, Dept. Mechanical Engineering, Imperial College London (2019.11-2020.5)

Student: James Eaton

Responsibilities included: literature review, model training and consultancy

Co-supervising research assistant, Dept. Mechanical Engineering, Imperial College London (2020.7-2020.8)

Student: Jake Reynolds

Responsibilities included: model training and consultancy

Undergraduate Research Opportunities Program, Imperial College London (2021.6-present)

Student: Jumana Mohamed

Responsibilities included: choosing research direction, technical discussion, proving self-built simulation tool

Co-supervising two postdocs, Imperial College London (2021.7-present)

Postdocs: Dr. Tao Zhu and Dr. Xuanze He

Responsibilities included: choosing research direction, setting research question and technical discussion

Conferences and workshops

2021 2nd Internal Symposium on Lithium Battery Fire Safety, Hefei, China (presenter)
2021 Faraday Institution MultiScale Modelling Workshop, London, UK (presenter)
2021 Advanced Automotive Battery Conference, Mainz, Germany
2020 Electrochemical Science and Engineering Group Showcase, London, UK (presenter)
2020 Oxford Battery Modelling Symposium, Oxford, UK
2017 Scale effect of evolving friction: from nano scale to macro scale, *World Tribology Congress*, Beijing, China
2016 Contact stiffness of a regularly patterned interface, *Gordon Research Conference-Tribology*, Maine, USA (poster)
2015 Effect of roughness on contact stiffness and real contact area, *The Chinese Congress of Theoretical and Applied Mechanics*, Shanghai, China (presenter)

Awards

Second Prize of annual academic seminar of State Key Laboratory of Tribology (2018)
Third Prize of doctoral forum of Biomedical Engineering (2017)
Postgraduate Fellowship of Scientific and Technological Progress, First Prize (2017)
National scholarship (one in Engineering Mechanics) (2012)
Undergraduate Fellowship, First Prize (2011)
Undergraduate Fellowship, Second Prize (2010)

Publications (Peer-reviewed journal articles)

Qiao, S., Li, S., Li, Q., Li, B., Liu, K. and Feng, X.Q. Friction of Droplets Sliding on Microstructured Superhydrophobic Surfaces, *Langmuir*, 33, 13480-13489 (2017)

Li, S., Yao, Q., Li, Q., Feng, X.Q. and Gao, H. Contact Stiffness of Regularly Patterned Multi-asperity Interfaces, *Journal of the Mechanics and Physics of Solids*, 111, 277-289 (2018)

Li, S., Zhang, S., Chen, Z., Feng, X.Q. and Li, Q. Length Scale Effect in Frictional Aging of Silica Contacts, *Physical Review Letters*, 125, 215502 (2020)

He Y., He, R., Guo, B., Zhang, Z., Yang, S., Liu, X., Zhao, X., Pan, Y., Yan, X. and Li, S. Modeling of Dynamic Hysteresis Characters for the Lithium-Ion Battery, *Journal of The Electrochemical Society*, 167, 090532 (2020)

Li, S., Kirkaldy, N., Zhang, C., Gopalakrishnan, K., Amietszajew, T., Bravo Diaz, L., Varela Barreras, J., Shams, M., Hua, X., Patel, Y., Offer, G. and Marinescu, M. Optimal Cell Tab Design and Cooling Strategy for Cylindrical Lithium-Ion Batteries, *Journal of Power Sources*, 492, 229594 (2021)

Lin, J., Liu, X., Li, S., Zhang, C. and Yang, S. A Review on Recent Progress, Challenges and Perspective of Battery Thermal Management System, *International Journal of Heat and Mass Transfer*, 167, 120834 (2021)

Edge, J., O’Kane S., Prosser, R., Kirkaldy, N., Patel, A., Hales, A., Ghosh, A., Ai, W., Chen, J., Jiang, Y., Li, S., Pang, M.C., Bravo Diaz, L., Tomaszewska, A., Marzook, W, Radhakrishnan, K., Wang H.,

Patel, Y., Wu, B. and Offer, G. Lithium Ion Battery Degradation: What You Need To Know, *Physical Chemistry Chemical Physics*, 23, 8200 (2021)

Hua, X., Heckel, C., Modrow, N., Zhang, C., Hales, A., Holloway, J., Jnawali, A., **Li, S.**, Yu, Y., Loveridge, M., Shearing, P., Patel, Y., Marinescu, M., Tao, L., Offer, G. The Prismatic Surface Cell Cooling Coefficient: A Novel Cell Design Optimisation Tool & Thermal Parameterization Method For A 3D Discretised Electro-Thermal Equivalent-Circuit Model, *eTransportation*, 7, 100099 (2021)

Unpublished work

Li. S., Zhang, C., Zhao., Y., Offer, G., Marinescu, M. Modelling inhomogeneous degradation in Lithium-Ion Batteries: The Effect of Thermal Gradients, to be submitted, *Nature Energy*

Zhang, C., Guo, Y., Wang, C., **Li, S.**, Curnick, O., Amietszajew, T., Bhagat, R. A New Design of Experiment Method for Lithium Ion Battery Model Parametrisation, submitted, *Applied Energy*

Projects

Postdoctoral period (2018.7-present)

As key member:

Innovate UK BATMAN project (with Caterpillar Inc.) (104180). I worked as the key modeller for cell-level battery simulation for 3 years in the whole project. I built simulation tool and coordinated with battery experimentalist in my group and engineers from the consortium.

Innovate UK project with China's top communication company HUAWEI. I worked as one of the two key modellers for 1 year in the whole project. I built modelling tool for the consortium and conduct simulation.

As team member:

Innovate UK project with Caterpillar Inc. (recently won, name is not known yet)

Innovate UK GENESIS project with BritishVolt Inc., one of UK's battery industry leaders

Innovate UK POWER-UP project with AMTE Inc., one of UK's battery industry leaders

Faraday Institution Multi-Scale Modelling (MSM) project (EP/S003053/1)

Innovate UK WIZer project (with Williams Advanced Engineering Inc.) (104427)

EPSRC TRENDS project (EP/R020973/1)

PhD period (2016.9-2018.6)

As team member:

National Natural Science Foundation of China (11422218)

National Natural Science Foundation of China (11772169)

National Natural Science Foundation of China (11432008)

National Natural Science Foundation of China (11921002)

National Natural Science Foundation of China (11890671)

Initiative Program of State Key Laboratory of Tribology (SKLT2019B02)

National Science and Technology Major Project (2017-VI-0003-0073)